THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. IX. No. 213—12th YEAR.] LONDON, DECEMBER 18, 1860. [Subscription per Ann. { 15s. in Advance / 18s Credit.] DOUBLE No. Price 1s.

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Aug. 22, 1856.

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The Drawings and Specification may be seen, and Forms of Tender and Conditions of Contract obtained on application at the Offices of the Gas Committee, on and after Wednesday next, the 19th instant.

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The Committee do not bind themselves to accept the lowest or any Tender.

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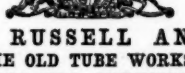

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I am, dear Sirs, your obedient servant,

CHARLES THOMAS, Superintendent, Rye Gas-Works.

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CAUTION.

TO GAS-METER MANUFACTURERS AND OTHERS.

THE Undersigned hereby caution Meter Manufacturers and others against infringing the exclusive right of the Undersigned to the use of the Screw Adjustment for regulating the Height of the Overflow-Pipes in Wet Gas-Meters, as described in the Specification of the Letters Patent granted to Crosley and Goldsmith on the 19th of April, 1856: as well as against infringing any other portions of that or any other Patent of the said William Crosley; and

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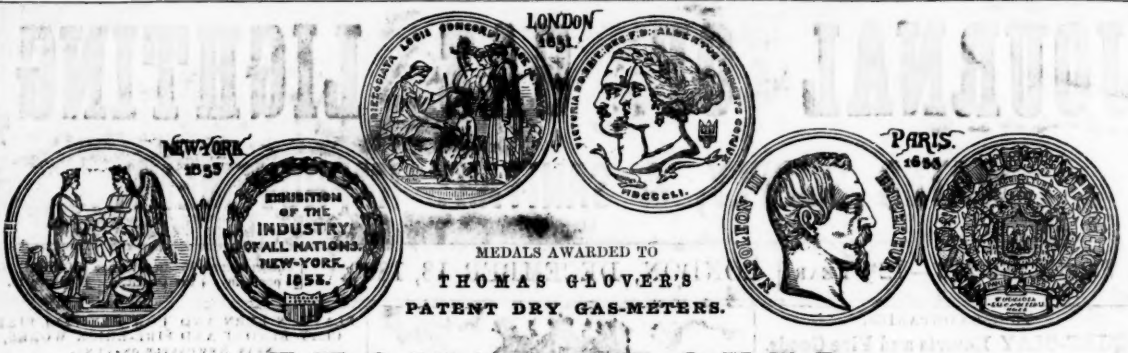

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LONDON, August 15, 1859.

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THOMAS GLOVER thinks it necessary to put Gas Companies on their guard against parties selling Patent Dry Gas-Meters constructed in imitation of his, but unskilfully made on erroneous principles, and with improper and unsuitable materials.

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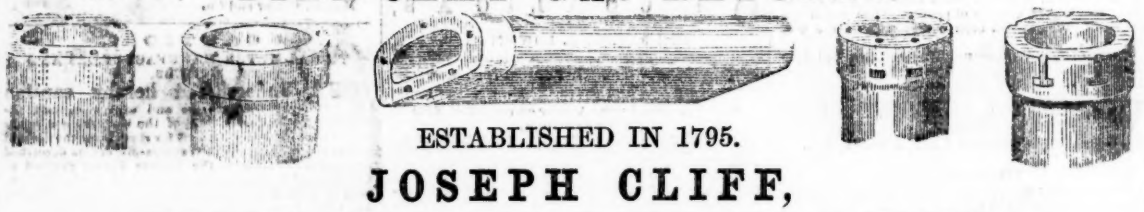

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JOURNAL OF GAS LIGHTING
NEWSPAPER

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NOTICES.

The subscription is 15s. per annum, if paid in advance during the month of January, or 18s. credit, in two sums of 9s. each, in July and January of each year. Post-Office orders must be made payable at the Charing-Cross Money-Order Office, to William H. Bennett, No. 42, Parliament Street, Westminster.

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This JOURNAL has been duly registered at the General Post Office for transmission abroad.

All Communications to be addressed to the Editor, No. 42, Parliament Street, Westminster; and orders for Advertisements to the Publisher, Mr. W. B. King, No. 11, Bolt Court, Fleet Street.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 18, 1860.

NOTES UPON PASSING EVENTS.

THE events of the past week in London have been essentially of an agricultural character. The Smithfield Club has held its ancient annual show of fat stock and its modern show of implements. The Royal Agricultural Society has held one of its three general meetings, and a move—a very feeble one, to be sure—has been made by a few of the agricultural gentlemen brought to town by the preceding meetings, to remedy the crying defects of the Arterial Drainage of England.

The Smithfield Club very usefully devotes its efforts to rewarding, and therefore cultivating, the breeds of animals most likely to provide meat for the million. It therefore, without knowing it, does sanitary work of an important character. Very little of the beef most esteemed at aristocratic tables is found there; large prizes fail to bring out any considerable number of those Scotch and Welsh cattle which fetch the highest prices at the butchers, and occupy the post of honour in the metropolitan market. It is the early mature, short-horn, and Hereford giants of beef that fill the longest lines of stalls, and regularly carry off the gold medals. Medical philosophers are sometimes shocked at seeing the muscle of prize cattle covered with so much fat; they do not see that, in such an operation as competition in laying on flesh, extremes are inevitable. There is never any fear that public health will suffer from animals being sent to market in too fat a state; fat costs money in cattle-food, and no grazier, except when running for a prize, will ever waste money in increasing the bulk of a truly ripe animal. A few years ago, one of the sanitary doctors, anxious to extend paid supervision to every butcher's shop, took the trouble to dissect the hearts and lungs of several prize animals, and, finding these organs in the over-fat, deteriorated state that might have been expected, founded on his examination a theory of great danger to the public from the consumption of over-fat animals. But this is quite absurd; a prize ox is not fit to run a race, or intended to run a race, but to be cut up and roasted or boiled; and, until the doctors can find a case of "Died from eating a slice of prize ox," they will do better to confine their attention, in the fat direction, to the results of eating the Strasbourg pies of the livers of diseased geese.

The number and importance of the display of Agricultural Implements at the Smithfield Club Show afford a striking example of the progress of mechanical skill and enterprise in that department. Sixty years ago, when the Smithfield Club had been founded two years, the Implement Show consisted of a few chaff-cutters and other contrivances for feeding stock. At present, a revenue of something like £1000 a year is derived from the rent paid by implement makers for the four days of the Show on about twenty-thousand square feet. This rent proves that an enormous business must be done every Christmas in steam-engines, ploughs, harrows, drills, threshing-machines, and other mechanical aids to farming, constructed in the best manner in factories devoted to the purpose. Twenty years ago, the village blacksmith and wheelwright almost entirely supplied the mechanical wants of the surrounding farmers.

The December meeting of the Royal Agricultural Society also proved that pressure had forced reform even on that most respectable, dignified, wealthy, and torpid body—the Council. For the first time, practical men have been admitted into the committees that settle practical subjects. Two agricultural engineers, and two or three real farmers, have been added to the *dilettanti* committee of peers and squires who have hitherto settled the prizes and trials of implements and machinery. It was high time, for the result of the competitive trials of the last eight years had been to bring the council into well merited contempt. The prize list just issued classes the different implements in a more rational manner than heretofore, and affords as fair a means of trying them as is possible, considering that for some the season is quite unsuitable, and for all the time allotted quite insufficient for arriving at any definite opinions as to their respective merits.

A very useful change has been made in the class for reaping-machines. These machines were introduced from America at the Great Exhibition of 1851, and were, perhaps, the most useful mechanical result of that display. Ever since, three different principles have been brought into competition at the meetings of the Royal Agricultural Society. All have received prizes, and it is impossible to gather, from the decisions or reports of the judges, what are the respective merits of the three. Bell's, the Scotch machine, *pushed* by two horses, is self-delivering, requiring no manual assistance. Burgess and Keys, *drawn* by two horses, is also self-delivering. Dray's, drawn by two horses, requires a man to sit on the machine and help the delivery with a fork, while a gang must follow to gather up and bind the sheaves before the machine comes round again. A fourth, Cuthbert's, drawn by one horse, without self-delivery, was tried last summer for the first time at Canterbury, and carried off the prize from Burgess and Keys self-delivering two-horse machine. One judge looked to economy in price and light draught of a non-delivering machine; another valued the saving of men's labour, even at the cost of horse labour; a third dwelt on the word "Reaper," and did not value the superiority that could cut and leave oats as well as wheat ready for next day's work. Bell's machine, tried on a flat, did its work well, and won a prize, but failed utterly when required to cut on a moderate ascent. None of these points are to be learned from the reports of judges or stewards. Equally absurd or obscure were the conditions under which threshing-machines and steam-engines were tried. In the prize list for the meeting at Leeds in July, 1861, amongst other reforms, reaping-machine trials are divided into—1, For cutting, with self-delivery; 2, Cutting, without self-delivery; 3, Combined reaping and grass mowing. The prizes for drills and horse hoes are arranged with like discrimination. So much for the introduction into the committee of men who really understand the matters they have to deal with. The motto of the Royal Agricultural Society is "Practice with Science;" but of late years the council has contained a large majority of noblemen and gentlemen with very little science, and less practice. A great Norfolk squire, himself one of the council, de-

scribed his colleagues as gentlemen "with very little knowledge, and a great deal of zeal." We cannot imagine a more dangerous and damaging conjunction. Only imagine intrusting a yacht, or a pack of fox-hounds, to much zeal, and little experience!

We recently called attention to the urgent need of improvement in the arterial drainage of England, remarking that for fifteen or sixteen years agricultural drainage, which carries rain rapidly from farm lands to the rivers, had been vigorously carried out, but that the main streams and rivers, destined eventually to receive the waters of the drains, had been neglected and permitted to be obstructed by both natural and artificial causes. On the 12th inst., a meeting of noblemen and gentlemen interested in the subject was held at the Hanover Square Rooms, and a discussion took place in which some important facts were brought out. A small committee was formed, and it was decided to go up in deputation to the Home Secretary, and press the Government to introduce a comprehensive measure for carrying out arterial drainage and improving outfalls.

Sir Henry Vavasour illustrated the evils of the present want of system by stating the case of three landowners :—

A has an estate, say about 35 feet above the level of the sea, which he under-drains, thereby sending an additional quantity of water upon neighbour B's land, a litte lower. C, who marches with B, finding himself uncomfortable from the improvements going on about him, asks for an inspection of his estate under the Inclosure Office, and receives a grant, being told to commence "hard all," otherwise it will be a lapse legacy. He succeeds in expending the money, and hopefully waits the result, but now come the troubles: first one tenant presents himself, then another, to complain of bad drainage. B's tenants become clamorous, and A's anxious; these three vexed spirits lay their heads together, and find to their consternation they have commenced operations at the wrong end; small thready drains extend in every direction, but the common outfall remains as before, a sluggish, meandering stream, running into a navigable canal, at the junction with which the course of the water is still further impeded by a dam, over which the water flows three feet deep. The local Act directs that the said dam should be "pulled up," whenever the water runs more than four inches over it. "True," say the trustees, "the Act says so, but it does not say so to us; this it says to the commissioners who cut the canal ninety years ago; all we have to do is to keep the dam in its place, and see that you do not take it up." C, not yet discouraged, and thinking his property has, to a certain extent, become a Government security, appeals to the Inclosure Commissioners, who thus reply, "Sir,—With every wish to be of service to you, we regret we cannot render you any assistance;" adding, however, subsequently, that C is authorized to inform the trustees they consider it most improper the works should be in the state represented. At this slight ebullition of wrath, the said trustees snap their fingers, and invite C to apply for a *mandamus*, telling him at the same time that an opinion having been taken some years before, his doing so will be a complete waste of money

Thus landowners, desiring to keep river valleys free of water, are embarrassed, not only by want of legal powers to remove private obstructions, but by constant conflicts between general and local Acts. A public official guardian of arterial watercourses is required in every valley district. Mr. John Clutton said that "there were thousands of acres in the valley of the Thames at present letting for 10s. an acre, which, well drained, would be well worth 50s. an acre. There was scarcely a valley in the country which did not want some remedial measure." As to the application to the Government, Mr. Wingrove Cooke, in a letter to the *Times*, observes very truly, that it will be perfectly useless in the present stage of the question. The Government have quite enough on their hands without inviting the opposition of every mill-owner in the kingdom. A commission, with powers like those of the Irish Encumbered Estates Court, is required to itinerate through the kingdom, and settle questions between land and river. The question of compensation must be adjudged by a competent commission, not a local jury, and the payment of prospective damages should be deferred until they have accrued. If the damages to mill-owners are to be assessed on the scale of railway damages, it will take millions to pay them, and they will be paid to those who have benefited by the change. But to initiate any such measure will require regular organization. The feeble murmurs of a deputation will do nothing. The committee must prepare a bill, and prepare the House of Commons to support it; then, if they are strong, the Government will be happy to take it up. Water-mills have been so much depreciated by steam-mills and railway conveyance that their owners will only be too happy to find a chance of making opposition a foundation for extravagant compensation.

The parties damaged by floods must make their market while the rain falls. In the valley of the Thames, the rainfall for the past year has been five inches beyond the average—twenty-four inches. But let dry weather return, and the need of drainage and unobstructed streams will be forgotten by half the agricultural interest.

It is a noteworthy fact, that this pluvious year has destroyed and choked up thousands of acres of makeshift shallow drains of the old patterns, bushes and stones, and proved the value of pipe tile drains, properly laid down. Sir John Tyrrell said a good thing at the meeting—"If they did not organize a large body of M.P.'s to make an impression on the Government, they would be bowled out almost before their wickets were pitched."

The *United States Railroad Register*, after quoting our remarks (Nov. 6) on the opposition of Lord Portman's agents to Mr. Train's Street Railway scheme, gives the following account of the introduction of that system into Philadelphia :—"The first modern city passenger car commenced running in Philadelphia in February, 1855, upon the North Pennsylvania railroad. The laying-down of the track through the old district of Kensington in the public streets was a work of difficulty. Years before, a legal contest between the district corporation and a railroad company, relative to the occupation of a certain street with railroad tracks, had resulted in the uptearing of the rails by a mob, and the destruction of property by fire. The only way to succeed was by conciliation and frank representations of the objects of the railroad company. Having adopted this course, the track was put down. There was, however a critical juncture, for the opposition issued a call for a public meeting, *and lithographed posters* were prepared, representing a railroad car wheel in the act of cutting a child's head off. By personal appeals, the parties to this hostile movement were persuaded to give up the meeting, and not issue the posters. The final city railroad for the conveyance of passengers in omnibus cars was in Fifth and Sixth Streets, and the opposition was so strong from property holders in those streets, that a long time elapsed before the needful Legislative powers could be obtained. The crowning opposition and last stand were made against the occupation of Chestnut and Walnut Streets, with a single track in each. The road was, however, put down. Now, the right-angled city of Philadelphia is reticulated with 154 miles of city passenger railroads, affording a constant and cheap communication between localities devoted to business pursuits and neighbourhoods occupied by private dwellings."

In the same paper there is a report of the sale by auction of 14,000 dollars, say £2800, of mortgage bonds of the Philadelphia and Baltimore Central Railroad, at 12¼ per cent. on their nominal value. This is not quite so low as the Real del Monte Mining shares of £1000 each, which, in the bubble year of 1825, were at cent. per cent. premium—the directors being the Buxtons, and other parties of the first class—and which eventually were sold for £2. 10s. each.

Mr. James Walker, of Great George Street, Westminster, has reported to the corporation of London that, if the Thames remains in its present condition, the repair or reconstruction of two arches of Blackfriars Bridge will enable it to stand for many years; but, if the embankment of the Thames is carried out, the channel of the river narrowed, and the flow rendered more rapid, then the whole bridge must come down. Under these circumstances, the reconstruction of the bridge ought to form part of the plan of the embankment, and be harmoniously arranged between the architect and engineer of the City of London, the engineer of the Blackfriars Railway Bridge, and the engineer of the embankment. It would be an opportunity for constructing a bridge worthy of London and the Thames.

The French government are reported to be contemplating the purchase of all the Railroads in that country. An article in the *Revue des deux Mondes*, in opposition to the project, points out that the Russian, Austrian, and Belgian governments, which all began by constructing Railroads, have found it advantageous to get rid of most of them and encourage private enterprise. Already the French government monopolizes "the manufacture of arms, gunpowder, naval architecture, public works, tobacco, salt, the conveyance of private messages by telegraph, the conveyance of small parcels, and controls the management of forests." It is the conservative or rather distrustful system which has caused France to be surpassed in Railway extension, not only by England but by Germany and Belgium. France is in the third rank, as regards the mileage of railroads executed or authorized by decree; in the fifth rank, in respect to the extent of her territory; in the seventh rank, in respect to the amount of her population served by railroads; and in every point inferior as compared with England and Belgium.

M. Barral's new periodical, the "*Presse Scientifique des Deux Mondes*," for November, contains some interesting letters from Sheffield, by M. Gustave Maurice; a curious

account of the history, rise, and progress of watchmaking in France; and a paper on submarine telegraphs, amongst many others of a less popular and more purely scientific character. The vast scale on which manufactures were conducted at Sheffield, as well as the minute attention paid to the smallest details, seem to have made a great impression on M. Maurice. As, for instance, that one house should make, amongst other articles, 1200 razors a week; and another, work up into knife-handles, every week, 3000 leg bones of oxen, from Russia, Australia, and the Cape—countries where the bones of this animal are closer grained than in England. Then, the brown paper in which all articles of cutlery are wrapped up, had nothing remarkable about its external appearance; but, on investigation, he found long rooms entirely devoted to drying this paper. "Each package is marked with the date of its delivery, and it is not until each sheet has been hung on a cord for a certain time that it is considered fit for use. A capital of £4000 is invested in this packing-paper alone. Sheffield, as well as Redditch, largely manufactures needles, for which the finest Swedish steel is used. In France and Germany, needles are made of iron wire; hence their inferiority to English. Although drawing iron wire has been carried to great perfection in France, they have not as yet succeeded in drawing steel. M. Maurice was much pleased with the manufacturing of steel bells, which are cast at Sheffield, even in large sizes, as easily as bronze. He also gives an account of Mr. Bessemer's steel-works, which. although closed to strangers, he succeeded in penetrating by "force of strategy, which he is willing to explain to any parties likely to visit Sheffield." M. Maurice does not say whether Mr. Bessemer approved of his ingenious device. After mentioning the failure of Mr. Bessemer's first experiments, he observes: "In France, such failures would have crushed the inventor and the invention, and, Mr. Bessemer ruined as a metal-founder, would have found it easier to borrow £4000 to found a café on the Boulevards than £4 to continue his interesting and laborious investigations. Happily for him, in England—a country which did not hesitate to expend half a million sterling to complete the last work of Brunel—he was able to obtain the needful capital."

In another letter, M. Maurice enters largely into the construction of teapots, in plated metal, the Britannia metal, and electrotype. Silver-plating, like porcelain or watchmaking, was introduced into France under Royal patronage and with Government funds. M. Maurice seems to think that electro-plate will altogether supersede plating by rolling. This is, we believe, a mistake; where much wear and tear occurs, the old style of plating is still preferred. German silver and Britannia metal seem almost unknown in France, and they electro-plate on yellow instead of on white metal. We have never seen any electrotyping in France to be compared with that of our best Birmingham manufacturers; but M. Maurice perhaps justly finds a want of graceful form in our spoons and forks. After an essay on the consumption of tea in England, and consequent prodigious manufacture of teapots, he devotes a few paragraphs to the condition of the workpeople. Of course, he was struck—what stranger would not be?—with the prevalence of drinking amongst the artisans of Sheffield. After quoting a passage in which M. Le Play speaks of "the happy result of the spirit of conciliation which usually distinguishes the higher classes of society in England, and the intelligence and moderation with which the workpeople have received conces-sions," he describes a group of the pretty cottages built by Messrs. Dixon for their workpeople in the suburbs, with each a little flower-garden in front and kitchen garden behind, let at moderate rents. "In order to encourage a taste for horticulture, the firm gives, twice a year, prizes for the finest flowers and vegetables. But how, you will ask (he continues), do the workpeople find time to work in gardens, being engaged the whole week in the factory? Sunday is out of the question, for every good Englishman is expected to be at church. 'Every Wednesday,' says Mr. Dixon, 'our men, women, and children have a half holiday, to use the spade and fork, without any deduction from their wages.' What do you say to such an expedient? Fifty-two holidays in a year for 600 workmen, make 15,600 days, which, at an average of 2s. a day, make £18,100 a year!" Certainly it is to the higher classes of literary and scientific Frenchmen that we must look to do us justice, and refute those charges of sordid, inhuman avarice and stupidity that the lower and popular religious and political writers in French newspapers are in the habit of casting upon English gentlemen and employers. Unfortunately, there are no cheap publications in France like those in which, with us, extracts from the best works and periodicals help to teach our multitude that foreigners are not the demons our forefathers believed during the time when Bonaparte was the bugbear of babies.

The following are the leading points of M. Parisel's paper "On Transatlantic Telegraphs." He proposes a thicker cable than that last employed, four copper wires, no iron wire sheathing, but a thick covering of silk, and a resinous composition, instead of caoutchouc or gutta percha. A resinous composition, he contends, may be easily worked up in the form of paste, its isolating qualities being undoubted, and its cost from one-fourth to one-sixth that of gutta percha. "The silk might be employed in two ways—first, in threads dipped in the resinous composition like the threads of hemp employed in rope-making, and then an outside covering of plain strong silk. As the diameter of this cable would be double that of the Transatlantic Cable, it would require two ships of 2000 tons each, or an arrangement for using four ships of 1000 tons. The route recommended is from the north-west of Scotland to the west of Ireland, from the west of Ireland to Greenland, and from Greenland to the nearest point of Labrador." We give this as the idea of an ingenious man, but with very little confidence in speculations on so practical a subject not founded on experience.

An Historical Essay by Dr. Lebon, of Besançon, "On the Statistics of Watchmaking in Franche Compté," quoted at one of the recent sittings of the "*Cercle de la Presse Scientifique*," gives the following details on that subject—"The first application of spiral springs to small clocks and watches appears to have been made at the end of the fifteenth century. Watches were made portable in the reign of Francis I. After the first attempts in France, England successfully competed for the monopoly of the export trade in horology. In 1685, the revocation of the Edict of Nantes drove from France, amid the crowd of exiles, a great number of watch and clockmakers, who settled in England and in Switzerland, and thus Geneva, which had previously only made enough for the home consumption, was able to establish an export trade. At the end of the reign of Louis XIV., France had not only ceased to export watches, but was obliged to import from England and Switzerland. At the commencement of the reign of Louis XV., the Regent established a watch manufacturer's, which only existed two years. Another attempt, under the patronage of the Duc de Noailles, to establish a manufactory at Saint Germain in 1724, was equally unfortunate. In 1758, Voltaire imported the best workmen from Geneva, and endeavoured to establish watchmaking at his village of Ferney, but without success. In the reign of Louis XV., young Caron, the son of a long line of clockmakers at twenty years of age invented a new escapement. The priority of this invention was unsuccessfully disputed by the horologer, Lepaute, before the Academy of Sciences. This victory obtained Caron an order from the king, and he manufactured a very small watch for Madame de Pompadour, and soon afterwards a repeater for the king himself, who was so delighted that he rewarded the mechanic by bestowing upon him letters of nobility. Thus Caron became at five-and-twenty De Beaumarchais, a name destined to be famous as that of the author of the "Barber of Seville" and the "Marriage of Figaro," as well as the founder of a newspaper.

Watchmaking did not long flourish under Lewis XV. after Caron became a noble and an author. Under the Republic, a citizen of Geneva, dissatisfied with political interference in his native country, emigrated to Besançon, with 80 foremen, and formed a little colony of Swiss, which in November, 1793, amounted to 400 souls. The decree approving of this colonization, and authorizing the representatives of Besançon, "in virtue of their *unlimited powers*," to afford the strangers all the assistance they might require, is signed by Carnot, Robespierre, Billaut-Varenne, and other members of the "Committee of Public Safety." It is curious to observe that, when conquest added Geneva to French territory, Besançon, previously flourishing, was obliged to give up competition with Switzerland; the establishment was eventually discontinued. In 1836, a decree of the Finance Minister authorized the establishment of a school of practical horology at Morteau; and the author dates the rise of the trade from this period—it was more probably due to the extension of Transatlantic trade. About that time, French watches came into common use in England, worn in the waistcoat-pocket instead of in the breeches fob. In 1848, a curious speculation very much injured the

character of French watches. Certain French publishers offered prizes of watches to those who subscribed to their periodicals. To meet this new demand, the watchmakers of Besançon supplied the article cheaper and cheaper; for two years this watch-making fever lasted, many watches were just able to go until the winner had walked the length of the street from the bookseller's shop. They were made not even to sell, but to be given away, and thus the watches of Besançon fell into discredit. England has maintained a good American, Australian, and China trade by a character for solid if inelegant watches, in spite of foreign competition. Amongst the novelties noted in the paper from which we have extracted the above information is a watch, invented by M. E. Piquet, with a third minute hand, thus giving not only the local, but what we should call in England Greenwich, or railway time. The time at Bourdeaux is 11 min. 40 sec. slower than in Paris; at Strasbourg, 21 min. 40 sec. faster. England retains its superiority in watches and chronometers calculated to resist great variations of climate; Switzerland excels in curiosities of watchwork. The *Scientifique* discussion, from which we have quoted, included papers on the manufacture gas from water; on a more healthy mode of lighting up the stage of theatres; and was brought to a close, comic in our English ears, by a M. Johard reciting a piece of poetry of his own composition—a sort of satire on free trade and competition, and plea for every man being his own shopkeeper, or, as he calls it, *monatopaly* against *monopoly*.

The question of the Cottage Accommodation—the most important social and sanitary question of the day—has recently formed the subject of a number of letters, one specially giving the statistics of Farringdon district in Berkshire, addressed to the *Times* newspaper. An Essay on the same subject was read by Mr, Scott Burn, and discussed at the Central Farmers Club on the 10th inst.; and it was also referred to at the annual meeting of the Royal Agricultural Society by one of the speakers, who recommended an inquiry into the cottage accommodation of our agricultural labourers as a subject the society might usefully take up. We are now slowly working out of the effects of the old vicious state of public opinion, when a labourer was looked upon as certain, at some time or other, to be dependent on parish relief, and therefore to be prevented from getting a settlement, if possible. Then, there were two—perhaps a dozen—labourers running after one employer; now, there are two employers running after each labourer. But the agricultural mind is slow to change old traditions. Two evils impede agricultural improvement and agricultural profits. In some instances, the labourer, compelled to dwell out of the parish, has to walk so far to and from his work, that he uses up a large per centage of his value before he begins his day's work; in others, he is crowded with his family in one or two miserable rooms, after a fashion equally fatal to health and decency. But, although this is notorious, it is difficult to get either farmers or landlords to meet the evil frankly; they fence with it; they make it a town and country question; or, like Earl Powis, the President of the Royal Agricultural Society, they waste time in detailing improvements that have taken place. Of course, there has been an enormous improvement in the condition of the agricultural labourer within the last ten years. He is better paid, better clad, and better fed; what he consumes is cheaper—his money wages are higher; great and successful efforts have been made to extend his education, and also, by many landlords, to afford the supply of cottages, which is as much needed as barns and stables. But the fact remains, that there are whole districts where the labourers are lodged like pigs, where fever lurks constantly and breaks out frequently, where young girls can have no sense of decency, and young men are poisoned physically and morally. And this crying evil can only be cured by searching inquiries, plain speaking, and constant agitation. There are cottages—nay, whole villages—on the estate of the Duke of Marlborough, which are a disgrace to a country with any pretensions to civilization; and it is no answer to this fact to say that the duke is a very good, well-meaning man, as he is, or that the Duke of Bedford and the Duke of Northumberland have built a great many capital cottages, or that cottages will not pay good interest for money. Farmers must learn to insist that the man who owns the land finds shelter for the labourers required to till it. We have had too much talking and writing about plans for cottages. The first point is, to make the best of existing cottages; the next, to ascertain and publish what is wanted in each parish. If the Royal Agricultural Society chose to take up this inquiry, the truth, without exaggeration, would be ascertained, and a public opinion would be created that landlords could not resist. But, if excuse and denial are to be the order of the day, the time will come when labourers will be wanted, and not to be had for money. Architectural extravagances are most to be dreaded in cottage reforms, for they lead to pulling down four old huts in order to build up two fancy ones, perhaps designed by a lady who knows nothing of a poor woman's wants. Prince Albert's much-praised cottages were quite unfit for working men.

Circular to Gas Companies.

An influential deputation from incorporated provincial gas companies, waited on the Secretary of State for the Home Department, on the 7th instant, to represent to him some of the imperfections of Lord Redesdale's "Sale of Gas Act," and to impress upon him the necessity for further inquiry, either by a parliamentary committee, or by a commission of scientific and practical persons, as a basis for further legislation. It is to be regretted that this step has been so long delayed, as, in the mean time, those illegitimate influences to which we have before alluded have acquired strength, and have inoculated the official authorities with their views. The appearance of the name of Mr. George Glover in the list of applicants for new patents, as the inventor of "Improvements in apparatus used in manufacturing gas," has increased the feeling prevalent against the employment of speculators in patents in official situations, where perfect independence is necessary to entitle the holders to the confidence of the public; and if the only effect produced by the recent movement of the gas companies should be the exposure of the jobbery practised in the introduction and passage of the Sale of Gas Act, and in the measures since taken to bring it into operation, one important service will have been performed. We believe, however, that further inquiry, in some form or other, will be granted.

It is with much pleasure that we announce the decision of the jury on the trial of the first of the three actions brought against the Great Central Gas Company in consequence of the fire on the premises of Messrs. Morley, in Wood Street. The hearing of the cause, and the deliberation of the jury, occupied two entire days; and the defendants had a multitude of witnesses in court whom their counsel did not think it necessary to call. To establish negligence against the gas company, the plaintiffs counsel, Mr. Hawkins, relied principally on the fact that the workmen had not "bladdered" the main, and inserted a T-piece. He stated that such a method was generally adopted, especially where the main runs close to the premises, as was the case at Messrs. Morley's; the distance of the Great Central Company's main being three feet and one inch from the wall. It was further asserted that the aperture made in the wall to admit the service-pipe was not stopped, and that the gas issuing from the hole made in the main-pipe directly into the basement, was there exploded by the lights supplied from the Chartered Company's main, and which continued burning. Though the non-bladdering of the main was the chief point on which the plaintiffs case was made to rest in the first instance, Mr. Hawkins shifted his ground as the case proceeded, for it was proved, even by their own witnesses, that it was not customary to bladder a 3-inch main, such as that of the Great Central's, for a 1½-inch service-pipe. The superintendent of the Chartered Company, who was brought forward by the plaintiffs as the principal supporter of their case, proved to be a capital witness in this respect for the defendants. His evidence, indeed, seemed to dispose of the case, for he admitted that the manner in which the men proceeded with their work was such as was customary at that time. Mr. Upward's presence on the scene, though fortunate for the defendants, as his evidence afforded them an answer to the action, was inopportune for himself; for, apprehending no danger, though he saw the hole in the main, he entered the warehouse to express his indignation at Messrs. Morley's conduct in changing their supply of gas without giving notice to the Chartered Company, but before he could "explode," as the Lord Chief Justice facetiously observed, the explosion of gas knocked him down, and he was obliged to escape, as best he could, through the skylight. Mr. Upward lost no time, however, in hurrying back to the trench, and there, in the excitement of the moment, whilst the fire was raging through the building, he thought he saw a jet of flame issuing from the aperture in the main,

and through the wall into the basement, a distance of about five feet. This marvellous jet of flame, even if it were not an illusion, and it was denied by other witnesses, would have afforded no proof that the gas from the main entered through the aperture, because, in the first place, the fire had destroyed the stopping of yarn, assuming it to have been there, and the heat of the burning warehouse would vastly increase the draught, and would draw the air strongly into any aperture through which it could gain entrance. But the hole in the wall was not the only possible way by which the gas could have obtained access to the basement. There was an open window below the level of the foot-pavement and under a grating; and, assuming the aperture in the wall to have been stopped, and that the explosion was caused by the gas of the Great Central Company, the open window seemed to be the only way by which the gas could have entered the basement. The want of bladdering having been nearly abandoned by the plaintiffs, as negligence, the case principally turned on the question, whether or no it was a want of proper precaution to make a hole in the main whilst the window was open and gas-lights burning? On this point, the engineering witnesses called for the defendants entertained various opinions. Some said that, as a measure of precaution, and to prevent nuisance from the smell of gas, they should have closed the window, though they should not have apprehended danger from its being open; whilst others said they should not have thought it necessary to shut the window, as it was extremely improbable that gas would descend so far below the top of the trench. It was, indeed, generally agreed that, though it was just possible the gas might be drawn downwards by the draught of air, it was a thing not to be foreseen that it should be drawn down in such quantity as to become explosive. It must be observed, that the main runs under the foot pavement, the upper part of it being nine inches below the surface, and that the trench made by the men was about eighteen inches deep; the earth would, consequently, be piled up on each side to the height of at least one foot above the level of the pavement. If, therefore, the gas entered the open window, it must have risen about two feet above the level of the aperture, and then have been drawn down, in opposition to its natural tendency to ascend, at least two feet, and entered a window that was upwards of four feet horizontal distance from the hole in the main; and the course of the gas, upwards and downwards, must have been at least two yards. To increase the improbability of the gas being drawn downwards and into the window, when diffused and ascending in the air, it was asserted that the explosion took place six minutes after the hole had been made, and during a part of that time the issue of gas must have been impeded by the insertion of the rymer to smoothen the orifice; and its progress to the window must have been further obstructed by the bodies of the men in the trench.

If, then, viewing all the circumstances after the accident, it seems most improbable that the gas should have entered the basement from the hole in the main in sufficient quantity to be dangerous, there is no reasonable pretext for charging the service-layer with having neglected to take proper precaution, as all former experience negatived the supposition of danger. The defendants endeavoured to show that it could not have been the Great Central Company's gas that produced the explosion, and that it was caused by an escape of the Chartered Company's gas from an unlighted burner, a smell of gas having been perceived before the main was opened, and the difficulty of otherwise accounting for the explosion, gave countenance so such a supposition.

The Lord Chief Justice, in his observations to the jury, set aside the probability of the explosion having been caused by any other means than by the escape of the Great Central Company's gas. In considering the question, whether the workmen were chargeable with culpable negligence, he said it was not sufficient vindication of their conduct that, they had proceeded to lay on the service according to the *ordinary method*, if it could be shown that that method was dangerous. At the same time, it might, he said, be assumed that in pursuing the method which had been ordinarily adopted for a long time without accident, they were taking the proper precautions which up to that time had been considered necessary, and they were not to be deemed negligent because the event had shown that the ordinary precautions were not sufficient precautions. To that extent the summing-up of the Judge was decidedly in favour of the defendants; but the circumstance that there were lights burning in the basement, the window of which was open, he considered took the question out of the ordinary method of proceeding. The men had, indeed, shown their consciousness of danger from the lights by asking Messrs. Morley's porter to extinguish them; but, on being told that the lights could not be spared, the service-layer raised no further objection. The Judge dwelt much on the fact mentioned by the inspector of the London Gas Company that, when there was no competition, they insisted on the lights being extinguished when laying down a service-pipe, but that they did not like to be peremptory about the matter when there was competition. This should be borne in mind as one of the effects of competition, for it is quite certain that if there had been no competition for the supply of gas, the lights would have been extinguished, and the premises of Messrs. Morley might not have been destroyed. The Judge observed that though the refusal of the porter to put out the gas might be urged in answer to the claims of Messrs. Morley against the gas company, it could not affect the claim of Messrs. Blenkiron, their neighbours, the plaintiffs in the case tried.

The jury deliberated upwards of three hours, and at one period it seemed probable that they would be discharged without giving any verdict. The foreman stated that they were divided in opinion as to which gas caused the accident, but there was only one juror who differed from the rest on the main question, whether the gas company took proper precaution. They afterwards agreed to a verdict that the company took "ordinary precaution," but that verdict the judge refused to receive. After further deliberation, they agreed that the company took "proper precaution," and that was entered as a verdict for the defendants. Had the case ended otherwise, it would have placed all the gas companies in the kingdom in a position of most serious responsibility. There was not much exaggeration in an observation made during the course of the trial that, if the plaintiffs obtained a verdict, it would be necessary to send an engineer, a chemist, and a lawyer, wherever a service was to be laid on or an alteration was effected; for if it were requisite to provide against all possible contingencies, a gas engineer alone, however experienced and skilful, would not be sufficient. Even as the question now stands, the opinion of the Lord Chief Justice, that ordinary precaution is not enough, involves the necessity of greater care than has been commonly observed; and, assuming the explosion in Messrs. Morley's warehouse was caused by the Great Central Company's gas, it shows that there may be great danger in circumstances that have hitherto been considered perfectly safe. A full report of the trial will be found in another part of our JOURNAL. The masterly summing up of the Lord Chief Justice forms a perfect code of the liabilities of gas companies on this particular ground, and its importance justifies us in recording it *verbatim* in our columns.

Review.

HANDBOOK OF COAL GAS LIGHTING.*

We took occasion, some time back, when noticing "our children" in different parts of the world, to speak in complimentary terms of our German son the *Journal für Gasbeleuchtung* at Munich, of which publication M. Schilling is the editor; and we have now to notice a work on gas lighting by the same gentleman, at the appearance of which the gas engineers of Germany have good cause to rejoice. The volume is a quarto, of the same size as "Clegg's Treatise on Coal Gas," though not containing so many pages as the third edition of that work, and it has been got up in admirable style. Clegg's Treatise has been taken as a model; and the author acknowledges that he has been greatly indebted to it and to the JOURNAL OF GAS LIGHTING for his information and illustrations. A history of gas lighting by Professor Dr. Knapp introduces the subject, which then commences with a consideration of the different qualities of gas coal, and of the analysis and illuminating power of the gas produced from them, including the use of the photometer. The settings of retorts are copiously illustrated, and many combined arrangements of clay and iron retorts are shown; but there does not appear to be anything novel in them. The work, indeed, professes to be only a compilation from various sources of the information most likely to be useful to gas engineers on the Continent, and it is well adapted for the purpose. It is very ably done; and the numerous wood engravings and lithographic drawings are executed in a superior style. A prospective view of the drum of a wet-gas meter conveys a better notion of the actual construction of that part of the instrument than we have hitherto seen. The descriptions of the various processes of gas making are not so fully given as in Clegg's treatise, and some of the subjects are omitted, or less variously illustrated; but the work is well fitted for the object for which it is intended, and the production of such a volume indicates the importance which gas lighting has attained in Germany.

* *Handbuch für Steinkohlengas-Beleuchtung*, von N. H. Schilling, Ingenieur und Director der Gasbeleuchtungs-Gesellschaft in München.

Register of New Patents.

1316.—The Rev. Henry Moule, of Fordington, in the co. of Dorset, clerk, and James Bannehr, of Exeter, agent, for "*Improvements in the nature and construction of closets and commodes for the reception and removal of excrementitious and other offensive matter, and in the manufacture of manure from thence.*" Patent dated May 28, 1860.

The first part of this invention consists in applying dry and powdered earths in closets and commodes suitably constructed, in such a manner that they shall be distributed over the surface of the excrementitious matters deposited in them; and the second part, in so constructing closets and commodes as that this object may be effected. The materials used in the first part are burnt or unburnt clay in a dry state and powdered; also loam or other fresh earths dried and in a state of powder.

1337.—William Renwick Bowditch, Clerk of St. Andrew's, Wakefield, in the co. of York, for "*Improvements in the purification of coal gas, and of coal oils.*" Patent dated May 31, 1860.

To carry out this invention, as much pulverized damp clay as there is room for is spread upon one of the trays of each ordinary dry-lime purifier, which contains upon the other trays slacked lime or hydrated peroxide of iron, and gas is passed through the purifiers in the ordinary way. When a purifier is empty, the partially foul clay is to be spread, so that the air may act upon it. After exposure it is used again, in combination with the other materials, and the best mode of using it is this:—A leading purifier is used, through which the gas is made to pass on its way from the condenser to the ordinary purifiers. This leading purifier should have four tiers or riddles. The two tiers nearest to the inlet should be charged with clay which has been employed in the ordinary purifiers, and subsequently exposed to the air. The next tier should be charged with sawdust, saturated with an acid or a solution of a metallic salt, suitable for removing ammonia; and the fourth tier should be charged with clay, like the first and second.

The gas then passes on to the ordinary purifiers, which should contain in each, as above stated, one tier of fresh clay, and the remaining tiers of lime or hydrated peroxide of iron. By the combination of the use of clay with the other materials, as directed, gas is better purified from sulphur compounds (other than sulphuretted hydrogen) than it can be by any other known method of cold purification. Where the purifiers are differently arranged, other arrangements of the purifying materials may be made, while the principle of the invention is preserved. The leading purifier should be emptied, and refilled whenever there is a sufficient quantity of partially foul clay, which has been taken from the ordinary purifiers, to fill it.

The patentee does not claim the use of any of the materials here specified for purifying gas, as they are all in use; but he claims the use of clay alternately with acids or metallic salts, and used in addition to lime or hydrated peroxide of iron. The foul clay forms a valuable manure, and the acids, when removed from the purifiers, are used to obtain salts of ammonia.

Another part of this invention consists in passing coal gas through pounded clay, hydrated peroxide of iron, or, preferably, slacked lime, heated below redness, as hereinafter described, and subsequently through the ordinary cold purifying materials, and thereby removing impurities not removable by processes at present in use. To prepare the clay, hydrated peroxide of iron, or slacked lime for use in hot purifiers, it is preferred to sift out from them such fine matters as will pass through wire gauze of 49 meshes to the square inch, and to have the purifying materials in small pieces, from about the 8th of an inch to 3-8ths of an inch in diameter. Lime is best got into this state by drying or partially drying, after it has been slacked, and natural oxide of iron, in lumps, and clay should be pounded, and the dust of the natural oxide should be moistened till they will aggregate into lumps, and then be dried artificially.

The purifying materials are to be heated to the proper temperature before the gas is passed through them, during which heating a little steam will be driven off. The water which is contained in the hot purifying materials, but is removable, as steam, at the temperature employed in the purification, must be driven off before the materials are in a proper state for purifying gas. The temperature required in the hot purifying materials may vary in some measure with the kind of coal and with the temperature which is employed in the production of the gas. For gas made at the ordinary temperature, it is found that the best temperature for the purifying materials is 280° to 300° Fah. Gas made at higher temperatures may require the purifying materials to be heated above 300°, and greater heat still may be required when the removal of the last traces of sulphur from the gas is of more importance than a loss of illuminating power. Care must be taken not to raise the temperature of the materials too high, as from the melting point of lead upwards there is considerable deposition of light giving matter upon the hot purifying materials, and with the purifying materials at a red heat the gas is almost spoiled. The rule should be to employ the purifying material at the lowest temperature, consistent with efficiency, and the limits will generally be found to be between 240° and 420°. The proportion of impurity removable at a lower temperature, than 240° is less than when the materials are heated to that point, though it is found that slacked lime, that has been properly dried, liberates in the form of sulphuretted hydrogen and other sulphur compounds, more than is generally found to be the case in purifying gas even of 108° Fah.

The vessels employed to hold the hot purifying material may be of any form, size, or material which may be found convenient; but it is preferred to have them cylindrical and of cast iron, with a door at each end. Each vessel should have an outer metallic casing or jacket, made steam-tight, so that steam may be employed as the source of heat to the purifying materials, such steam being applied by injecting it between the purifying vessel and its outer coating; or water may be converted into steam within the space between the purifier and its jacket by a direct application of heat to the outer casing. It is preferred to pass in steam, heated to the proper temperature, and not to use direct heat where steam is available.

The purifiers may be fixed vertically or at any convenient angle with the horizon, which will allow the purifying material to occupy the space within in such a manner as that no gas can pass through without coming into contact with, and passing through, the heated purifying material. They need not be more than three or four feet in length, and should be of such breadth as will allow a ready passage to the maximum quantity of gas made in a day. As a guide to the quantity of hot purifying material required in order to break up the sulphur compounds usually found in gas, and to liberate their sulphur in the form of sulphuretted hydrogen, the gas containing the sulphur compounds should pass through about three feet thickness of hot purifying material, prepared as above described. To charge the purifiers, the door at the lower end is fastened; the purifying material is put in at the upper end, and the purifier is filled nearly full, so that gas being passed through it must come in contact with such material. A simple test to ascertain whether the purifying material requires changing is the application of lead paper to the gas, which is passing immediately from the hot purifiers. If it blackens the lead paper strongly and quickly, the purifying material may be considered in order; if it do not, it should be changed. The gas which has passed through the hot purifiers is to be cooled in the ordinary manner and to be passed through cold purifiers of the ordinary kind, containing materials suitable for the removal of sulphuretted hydrogen, ammonia, and carbonic acid.

It is preferred to subject the gas to the ordinary cold process of purification before using the above processes, as then the hot purifying material will not become clogged with the tar, and cold by water which has passed the condenser; but these will have been deposited in the cold purifiers. This process may, however, be applied to gas as soon as it leaves the condenser, before it passes into the ordinary purifier, but with less effect and more trouble than when the gas has been first subjected to the cold process of purification.

This invention may be applied to gas by consumers upon their own premises, in which case the gas that leaves the meter is made to pass through a small purifier, containing hot slacked lime, pounded clay, or hydrated peroxide of iron; and secondly, through another purifier, containing layers of ordinary cold purifying materials; after which it may be burnt. The pressure of the gas upon consumers' premises is not often enough to overcome much resistance; wherefore the cold purifying material should have the dust sifted out, as above advised for the hot, and then the gas will pass through the purifiers without any perceptible loss of pressure.

Another part of this invention consists of purifying coal oils by means of heated slacked lime, pounded clay, or hydrated peroxide of iron, in the same way as in the purification of gas. A vessel is to be employed, similar to the above specified, or of other convenient size or form, which vessel is to contain sifted slacked lime, pounded clay, or hydrated peroxide of iron, but preferably lime heated to but slightly above the boiling point of the oils to be purified. When the purifying material is at the proper temperature, the oils are to be sent into the lower part of, and allowed to pass upwards through the hot purifier, after which they are to be condensed in the usual way. Care must be taken not to send in the oils too rapidly. The gas produced in the process should be allowed to escape into the atmosphere, or better, be absorbed into slacked lime. Care is required to prevent the tar liberated by this process from passing over with, and becoming absorbed in, the purified oils. The tar will not pass with the purified oils, if the purifying material be not saturated with oil; but it will pass if the purifying material is saturated. It is requisite, therefore, to supply the hot purifier with the coal oil slowly, so that the purifying material may not become saturated. The purified oil will then be of good colour. The oil passing from the purifier and through the condenser should be received into a glass vessel at intervals and examined; and, if found coloured, the quantity passing through the hot purifier should be lessened. If with a slow current the distilled oil be coloured, the hot purifier should be charged with fresh purifying material.

The purified oils absorb some part of the gases produced in the process of purification, which gases evolve more odour than the oils have naturally. Such gas may be removed, and the smell of the oils improved by washing them with a solution of caustic soda or potash, and subsequently with water. The quantity of removable matter is so small that a weak solution of alkali is sufficient, and the oils without it are so good that probably the washing will not be thought necessary, except where smell is of great importance. Experience shows that a quantity of heated purifying material, equal to about a fourth of the weight of oil to be purified, gives an excellent result.

The claims are—

1. For the combination of the use of pounded clay with acids or with salts, and with slacked lime or oxide of iron, as described.

2. The passing of coal gas through slacked lime, pounded clay, or hydrated peroxide of iron, heated below redness, as described, by which sulphur compounds, now generally found in what is termed purified gas, and water, are decomposed and liberated as sulphuretted hydrogen and carbonic acid; the sulphuretted hydrogen so generated, together with the carbonic acid and ammonia, being afterwards removed by the ordinary means of purification.

3. The passing of coal oils through slacked lime, or pounded clay, or hydrated peroxide of iron, heated above the distilling point of the oils, as described, by which treatment tar and sulphur compounds are removed, and the oils are rendered whiter and free from disagreeable smell.

1343.—James Alexander Manning, Esq., of the Inner Temple, London, for "*Improvements in the treatment, application, and use of sewerage matters, and the general wastes of towns and factories.*" Patent dated May 31, 1860.

This invention relates to certain improvements in the treatment of sewerage matters, and the general refuse or waste matters of towns, whether of animal or vegetable origin, together with the refuse coal, ashes, and cinders when mixed therewith. Under these improvements there is one generally effective system of treatment for the wet or sludgy deposits of such matters, and another system of treatment for the dry refuse or waste of towns, including the sewerage deposits after having gone through the desiccative processes detailed by the inventor in former patents. This system is applicable to all towns, and a thoroughly concentrated manure may be thereby secured for the permanent benefit of agriculture. By

these improvements great economy is obtained over the modes of treating such matters described in the specifications of letters patent granted to th present patentee on the 7th August, 1855, 5th July, 1856, and 1st Fe bruary, 1858; whilst, from the greater efficacy of the manure and its diminished bulk, a corresponding advantage ensues to agriculturists in its application to the soil, as well as great economy in its transit.

In the present invention, alum sludge, or its chemical equivalent, as ascertained by analysis—that is to say, amongst other matters, its principle constituents of sulphate of alumina, sulphuric acid, and peroxide of iron—is the chief agent for the deodorization of the sewerage waters, and the precipitation as well as the deodorization of all the animal, vegetable, and organic matters held in suspension therein.

The silicate of alumina obtained from the refuse of bog cannel coal, after the gas has been extracted therefrom, is also used, either by itself or converted into some other form of alumina, to assist in the process of precipitating the animal and vegetable organic matters held in suspension in sewerage waters. Waste animal charcoal, which is now occasionally employed by the present patentee as a decolourizer of the supernatant water, as well as a fertilizing agent in the subsequent preparation of the manure, is also used for the purpose of this invention, when desirable. But instead of applying the before-mentioned substances in the first tanks or receivers of the sewerage from the common sewers, all matters capable of subsidence or deposit by their own specific gravity, such as road sand, street mud, and earthy matters in general, are allowed to settle down for a certain time—say for one or two hours; the supernatant water is then drawn off, or discharged into a tank or tanks at a lower level, to which is added one-half of the quantity of alum sludge, or its chemical equivalent, which is found sufficient to ensure precipitation of the finer and more valuable particles of matter still held in suspension in the water. Instead of drawing off the supernatent water into tanks at a lower level, it is preferred in some cases to sink in the channel which conveys the sewerage water from the common sewer to the tanks, a series of pits or cesspools, four or more feet deep, in which the road sand, street mud, and earthy matters, or the greater part thereof are deposited by their own specific gravity. By these means a saving of 50 per cent. is effected in the employment of the alum sludge; for experience has proved that the less the sewerage is charged with earthy matters, not only is the deposited matters obtained infinitely more valuable for the use of agriculture, but the smaller is the quantity of alum sludge necessary for the precipitation of the animal and vegetable organic matters held in suspension therein. With respect to animal charcoal employed in this process, when necessary or desirable, a considerable change is effected in the mode of using it. The charcoal is made from the hoofs or horns of animals, and is a waste or refuse substance arising from the manufacture of prussiate of potash. It contains a considerable amount of alkaline salts amongst its other impurities, which are of no use in the decolourizing or the precipitation of any colouring matters in the sewerage waters. The charcoal is therefore lixiviated, and afterwards dried in a furnace or oven, or by exposure to the atmospheric air, before applying it in conjunction with alum sludge as deodorizers and precipitants of matters held in suspension in the sewerage and an additional clarifier of the supernatant waters. If found useful and profitable, the water of lixiviation may be evaporated for the purpose of obtaining whatever salts may be dissolved therein for admixture or otherwise with the manufactured manure.

The present invention or process is applicable to the treatment of the waste of towns of almost every kind, whether of animal or vegetable origin—that is to say, to the contents of cesspools and privies, mixed or unmixed with coal, cinders, ashes, household waste, stable manure, the refuse of flesh, fish, and vegetable markets, as well as those of slaughter-houses, breweries, distilleries, tanneries, glue factories, cotton works, the refuse of dust-bins, and all generally similar matters of animal and vegetable origin, including also the sewerage deposits after being treated by the process hereinbefore mentioned.

In carrying these improvements into practical effect, it is preferred to use the following apparatus for effecting the destructive distillation of the refuse matters. A series of three or other suitable number of cylindrical vessels or retorts are arranged in a stack or bench in the brickwork. The retorts are formed of iron, and they are disposed in the brickwork at an angle, so as to admit of their contents being readily discharged from the lower ends. The lower extremity of each retort extends over a vertical opening or recess in the brickwork, which affords access to the end of the retort, and this part of the retort is enclosed by a semicircular end plate, to which is hinged a flap-door, shutting in the other portions of the end of the retort. At the side of this recess in the brickwork, or at any other convenient part of the same, is arranged a furnace for desiccating the matters placed in the retorts. The furnace flue is carried round the retorts, so as to obtain the desired heating effect from the fuel, and a corresponding arrangement is common to use the retorts in the series. Branching away in a lateral direction from the upper part of the retort is a pipe for conveying away the gaseous products evolved from the refuse matters, or applying heat thereto. This pipe is carried upwards in a horizontal direction, and is then bent downwards, so as to dip into a tank or reservoir containing water, which serves to absorb and condense the gaseous products. It is desirable to form this refrigerator as a close vessel, so that when the water contained therein is saturated with the ammoniacal gaseous products the other gases pass through an elbow pipe, fitted to the upper part of the refrigerator, and are conveyed into a second refrigerating vessel, arranged in convenient proximity to the first. It is preferred also to arrange the retorts so that their respective gas-pipes may be readily carried into the refrigerator. To this end the retorts may be conveniently arranged in a radial direction, the several gas-ducts converging to a central refrigerator, or series of refrigerators. The upper end of each retort is fitted with a hopper, to convey the refuse materials into the retort, and extending across the open end of the retort is a sliding door or damper, for preventing the escape of gaseous matters. The sliding door is pushed to and fro by means of a lateral projecting handle, and the door, when pushed home in its receiving groove, may be luted, if required, to prevent the escape of gaseous matters. The interior of each retort is fitted with an agitator, so as to stir the mass of material in the retort, and bring the whole in contact with the heated surface. The agitator consists of a central longitudinal shaft, supported in foot, step, and collar bearings in the retort and furnace, with radial projecting arms. Motion is given to the agitator by means of an ordinary winch handle fitted on the square extremity of the shaft, as it is only necessary to stir the materials from time to time. But where the manure works are of considerable magnitude, the agitators may be driven by steam-power, the motion being imparted by spur gearing, which is put into and out of gear by means of a coupling, as required, or the agitators may be actuated at intervals by self-acting mechanical means. Upon the refuse matter being placed in the retorts, the fires are raised so as to bring the retorts up to a low red heat, or such a temperature as will destroy the organic matters as far as possible and requisite, but not sufficient to decompose the salts contained therein, or cause vitrification of the silicates. By means of the agitator the mass is broken up, and the undried portions are brought into contact with the heated surface; the gaseous products meanwhile pass off by the gas-ducts to the refrigerators. The rotary motion of the agitator in each retort serves also to assist in pulverizing the mass, so that when the cinders are separated from the desiccated materials, all the products which are of value as manure are in a finely-divided state, and in the best and most effective form for application to the land. The cinders, or other similar matter, are readily separated from the manure by means of a sieve arranged in a sloping position, and fitted below the lower extremity of each retort, so that when the contents of the retorts are discharged, the desiccated manure falls through the sieve into the recess in the brickwork and the cinders fall outside, and serve to supply the furnace for heating the retorts. Fœcal matters, when obtained without admixture, may be treated by distilling them to dryness in large cast-iron stills, the ammoniacal vapour being conveyed into refrigerators as hereinbefore described. In some cases, the ashes obtained after the destructive distillation of the refuse matters, as well as the waste matters of towns not previously subjected to distillation, may be placed in large wooden or other suitable covered receptacles, for the purpose of subjecting them to the action of steam. This mode of treatment is for the purpose of dissolving out the alkaline or other soluble salts from the mass. The water of condensation, or solution containing the soluble matters, is subsequently evaporated or otherwise treated for the purpose of obtaining the valuable salts therefrom. The ammonia which is evolved from the materials in the retorts is absorbed by the water in the refrigerator, and this ammoniacal liquor is converted by the ordinary chemical process into sulphate of ammonia. If, however, it is found that the gaseous products evolved from the refuse materials in the retorts contain a sufficient amount of hydrogen and carbon, these gases may be judiciously applied to the illuminating of the manure works or other generally similar purposes. In boiling or distilling ammoniacal liquor, in order to deprive it of its ammonia, it is usual to run off the liquor after the first boiling into a suitable vessel, and apply lime thereto, and redistil it. This process is shortened by adding the cream of lime to the ammoniacal liquor in the boiling or distilling vessel after the distillation has proceeded to a certain extent, the solution of lime being pumped into the boiler by means of a force-pump. All the ammoniacal products of the liquor are then obtained and drawn over into the sulphuric acid tun at one instead of two operations. By these means the refuse matters of towns are utilized to the utmost extent, and are again made subservient to the purposes of agriculture and commerce.

The claims are for—

1. The system or mode of treating sewerage and fœcal matters, and the general refuse or waste matters of towns, factories, mills, and other generally similar places, for the purpose of obtaining manure and other useful products therefrom, as hereinbefore described.

2. The general arrangement and construction of the machinery or apparatus for treating the refuse or waste matters, and obtaining manure and other useful products therefrom, as hereinbefore described, or any mere modification of the same.

3. The system or mode of treating sewerage by running it or allowing it to flow into a series of tanks or reservoirs, in order that it may deposit the sand, mud, and earthy matters—the supernatant fluid being subsequently run into other tanks or receptacles, where it is treated with alum, sludge, or other suitable precipitant, for the purpose of throwing down the fine particles of matter held in suspension, as hereinbefore described.

4. The application and use of the silicate of alumina obtained from the refuse of bog charcoal, to assist in the precipitation of matters held in suspension in sewerage and other generally similar matters, as hereinbefore described.

5. The application and use of the combustible gases obtained from the refuse matters to the purpose of illumination and heating, as hereinbefore described.

6. The system or mode of utilizing the gaseous products arising from the treatment of refuse matters in retorts, so as to obtain from the ammoniacal liquor so produced the sulphate or other salts of ammonia; also the mode of applying the solution of cream of lime to the partially-distilled liquor in the boiler or distilling vessel, as hereinbefore described.

1344.—JOHN KINNIBURGH, of Shott's Iron Works, in the co. of Lanark, N.B., for "*Improvements in the manufacture or production of metal pipes and other generally similar tubular articles.*" Patent dated May 31, 1860. This invention relates to the application or employment and use of cast or malleable iron moulds in casting of metal pipes, instead of the common moulds of sand or loam. According to these improvements, it is preferred to make the pipe mould in two longitudinal sectional halves, turned or smoothed, or not, in their interior. These halves, when put together with their joint edges abutting, form the complete circle necessary for producing the external figure of the pipe, the interior being coated with blackening or other suitable coating. The two halves are held together by means of metal rings of somewhat larger diameter than that of the metal mould, wedges being inserted between the rings and the mould to bind the two halves together, and yet allow for the lateral expansion of the metal mould when the melted metal is poured in to produce the casting. Or, instead of using these binding rings, clamps or screws may be used, or flanges may be formed at intervals upon the two halves of the

mould, holes being made through such flanges for the insertion of wedges or pins at or near the parts where the junction edges come together. Any suitable core may be used in these moulds. They make fine smooth castings, and may be used for casting in continuously without any alteration or breaking up as in ordinary moulds. Various articles in addition to pipes may be cast in such moulds.

Under other modifications of this invention, the cast or malleable iron moulds are arranged and constructed in one piece, or in a greater number of parts than two; for although the preference is given to the mould being formed simply in two parts, it is by no means intended to be understood that the invention is confined thereto. In forming the mould in one piece for casting pipes and other generally similar articles, it is preferred to compose the mould of cast-iron, with a longitudinal slit or opening throughout its length. The parallel edges of this opening are brought together by means of malleable iron rivets fitted on the opposite side of the mould, and when the melted metal is poured into the mould, these rings admit of the lateral expansion of the metal. In lieu of this arrangement, the mould may be formed without the longitudinal opening, provided it be fitted with external rings of wrought-iron to prevent the fracture of the cast-iron mould when the molten metal is poured in. Preference, however, is given to the system of forming the mould with the longitudinal opening, which more readily admits of the lateral expansion. In this manner also these metal moulds may be arranged in three or other number of pieces according to the size or external contour of the pipe or other article to be cast. In commencing to cast articles with moulds constructed according to these improvements, it is preferred, when necessary, to heat the mould in any convenient way, in order to prevent the too sudden chilling of the article to be cast. After the preliminary heating the subsequent operation of casting is sufficient to keep the mould up to the requisite temperature. With attention to this point, castings produced from these moulds are much superior to those obtained from the ordinary sand or loam moulds; and the system is perfectly applicable to the casting of axle-bushes, and a variety of other generally similar articles, either in brass or iron.

The claim is for—

1. The system or mode of manufacturing or producing metal pipes, and other generally similar articles, in which the external mould is formed of cast or malleable iron, arranged either in one, two, or other convenient number of parts, as hereinbefore described, or any mere modification of the same.

2. The system or mode of arranging and constructing moulds for casting pipes, and other generally similar articles, by forming them of one, two, or more pieces, of cast or malleable iron, which, when put together, form the complete external mould, due provision being made for the lateral expansion of the mould by means of rings, wedges, clamps, pins, or other suitable contrivance, as hereinbefore described.

1353.—William Edward Newton, C.E., of 66, Chancery Lane, London, for "*A new and improved regulator for gas-burners.*" (A communication.) Provisional protection only obtained. Dated June 1, 1860.

This invention of a new and improved regulator for gas-burners consists of a combination of a valve with an independent weight, or its equivalent, and a stop, the whole applied, arranged, and operated within a burner, to produce an uniform, or nearly uniform, issue of gas from the burner, and consequently an uniform, or nearly uniform light, under all variations of pressure in the main, or in the pipe which supplies the burner.

The socket of the burner is attached to the pipe which supplies the gas, and is made in the form of a cup for the valve-box to rest on. The body of the burner fits into it, and is screwed in such a manner as to secure the valve-box in place. The valve-box is of the form of an inverted cup, having the sides of its interior tapering upward slightly in a conical form, and terminating in a dome-like form at the top, in the centre of which there is an opening, which is the only means of egress for the gas to the tip of the burner. The box has also grooves running up the sides of its interior for the passage of gas between it and the valve. The valve is also of an inverted cup form, having its exterior of a shape corresponding with the shape of the interior of the box, and having a short stem, which passes through the opening at the top of the box. This stem is provided with a small transverse pin, which rests upon the top of the box, and keeps the valve suspended when there is a very slight pressure of gas or when the gas is shut off from the burner. The weight is formed with grooves, to slide up and down in fixed vertical guides which are attached to the top of the valve-box, and rests upon it, so that, when the valve is suspended by its pin, the top of its stem may be at a considerable distance from the weight, which is therefore, to a certain extent, independent of the valve.

The regulator operates as follows: The gas, on entering the burner, passes into the valve, and under the edges of the valve, and between it and the interior of the box, then over the top of the valve, and through the orifice in the head of the box, and from thence to the top. At the lowest pressure, the valve is suspended by its pin from the top of the box. As the pressure increases, the gas raises the valve, and so causes the contraction of the passage between the valve and the sides and head of the box, and when the pressure reaches a certain point, the top of the stem of the valve comes in contact with the weight, which, being light, is soon raised by an additional increase of pressure, the contraction of the passage still continuing till the weight comes in contact with a stop. The rise of the weight to this point only occurs in case of an excessive pressure, and the valve is then very nearly up to the head of the box. The stop is merely to prevent the valve closing the opening, and shutting off the gas entirely. As the pressure diminishes, the valve descends, and gives a greater area for the passage of the gas. The sides of the exterior of the valve and interior of the box may be cylindrical; but in such case the side passages will be required to be more taper than when the sides of the box are more conical.

1401.—Robert Bromwich, general cock fonnder, liquor fountain and beer machine manufacturer, of Birmingham, for "*An improved cock for drawing off or regulating the flow of liquids or fluids.*" Provisional protection only obtained. Dated June 7, 1860.

These improvements consist in admitting the water at the bottom concentrically with the vertical action, and by causing a lower valve to rise, so as to allow the water or fluid to ascend and escape through the delivery-pipe without regard to its position, as it may be placed in front or at the bottom as desired. The top of the body of the tap is extended for the purpose of obtaining a valve-seat, as well as for the means of connecting a shield or cover over it, to be held down in any suitable way, securing at the top a valve between it and the body, and which top valve may be of leather or indiarubber, or other suitable material, which is made to rise and descend vertically by the action of the key or handle, the turning down of which depresses the top-valve, and presses the lower one in close contact with its respective base or seat, thereby cutting off all flow, and by reversing the handle or key, the top valve will be drawn up into a convex shape, thereby lifting the lower concentric valve, and opening the water or fluid way. The manner of lifting and depressing the valves is by means of a small quick screw, the male or female portion of which may be fixed to the top dome or cover, and the corresponding part concentrically to the top valve. This simple construction of the tap will always work pleasantly, and not be liable to deteriorate or leak from the action of the fluid or liquid required to be drawn through it; and when leakage takes place, a new valve may be applied at a trivial cost and without inconvenience, as a small bit of leather or other such like material is all that is required, and as no grinding or fitting of plugs is comprehended in the construction of this tap, its cheapness is insured.

1380.—George Bower, of St. Neots, Hunts, gas engineer, for "*Improvements in apparatus for manufacturing, controlling, and regulating the flow of gas.*" Patent dated June 5, 1860.

These improvements consist, firstly, of a generator for the manufacture of gas, which is, to a certain extent, an improvement upon the gas generator for which the present patentee obtained letters patent on the 9th of February, No. 368. Upon a strong metal frame, which carries a set of circular fire-bars, is placed an upright cylindrical or slightly conical fuel-chamber or furnace, of metal, lined internally with fire-brick, and fitted on opposite sides with double doors, one above the other. The upper doors are for the purpose of supplying fuel; the lower ones for cleaning the fire-bars. A suitable smoke-flue is connected with the upper part of the furnace. In the centre of the furnace or fuel-chamber, and projecting slightly above and below it, is placed a cylindrical cast-iron retort, the lower end of which is capable of being closed by a disc-plate and luted door, opened and shut by means of a forked lever when the spent charge is to be withdrawn from the retort. At the upper end of the retort there is a cast-iron chamber closed by a luted plug at the top, with an outlet at one side for the passage of the gas to the purifier.

The coal, lignite, shale, or other solid material, is fed through a hopper into the retort, and allowed to remain there until the whole of the gas is extracted from it; but if the gas is to be made from liquid materials, the retort is filled with charcoal or coke, and the liquid materials admitted at the bottom of the retort, when their vapour passing through the incandescent matters will be converted into permanently elastic gas. When gas is to be made from peat, wood, or other similar substances, the retort should be nearly parallel throughout, and of an oblong shape, with a diaphragm nearly in the centre, the gas-producing material being placed in the largest compartment. The smaller is filled with small coke or charcoal, through which the condensable gaseous vapour being caused to pass is converted into incondensible gas.

This generator may also be used for the manufacture of oxygen or of carbonic acid gas. In the former case the retort must be charged with black oxide of manganese, in the latter case with chalk, or other suitable material.

These improvements relate secondly to governors for controlling, regulating, and equalizing the flow of gas. A cylindrical box and cover is furnished with an inlet and outlet-pipe. In the centre of the box a valve of parabolic form is suspended by a cup and ball joint on the lower end of a rod, which works vertically through a bush in the cover. This valve, when raised, hermetically closes the inlet orifice. The upper end of the valve-rod is attached to one end of a lever, terminating in a pointer, which traverses between two adjustable stops, by means of which the range of the governor can be regulated, and its action limited at pleasure. To the valve-rod within the valve-box is attached a gasholder, working in water. When the gas enters the governor it raises the holder and valve, and would entirely close the valve, but that the opposite end of the pointer lever before mentioned is weighted so as to maintain an uniform pressure, previously determined upon. The holder and valve rise and fall as the pressure of the inflowing gas is greater or less than the prescribed amount, thus regulating and equalizing the outflow. By these means any required degree of pressure (less than that of the inflowing gas) may be maintained in the supply-pipe.

The claim is—

1. For the general arrangement and construction of generators for the manufacture of illuminating gas from coal, lignite, shale, oil, or other liquids, as hereinbefore described.

2. For the application of generators, constructed as hereinbefore described, to the manufacture of oxygen and carbonic acid gas.

3. The adaptation and use of the hereinbefore described generators for the manufacture of illuminating gas from peat, wood, and other similar substances.

4. The construction and arrangement of governors for regulating and controlling the flow of gas, as described.

1407.—George John Cookson, of Dorset Street, in the City of London, printer, for "*Improvements in gas-regulators.*" (A communication from James Gabriel Pavyer, of St. Louis, U.S.A.) Patent dated June 7, 1860.

This invention consists in constructing gas-regulators in the following manner:—The case or shell of each regulator is composed of two hemispherical, or approximately hemispherical, pieces of metal, which are connected by flanges formed around them, and screws passing through these flanges. A pipe or tubular projection extends from the lower side of this case or shell, and another stands out from the side of the case, having its upper end turned up, and screwed to receive a burner, or a branch leading to several burners. Between the flanges of the case is clipped the outer

edge of a circular disc of leather, or other material suitable to form an elastic diaphragm, which disc is held around its centre between two plates, below the lower of which is a nut, and above the upper of which is a nut and a cup for holding shot or other weighty substance. The central plates, nuts, and cup are all held together by the screw end of a rod, the screwed portion of which passes through them, and the lower end of which depends vertically, carrying at bottom a convex valve, with its convexity turned upwards. This valve comes against a seat formed within an union, which is screwed upon the pipe or tubular projection at the bottom of the case. On the upper side of the case is placed a removable cover, with an aperture in the centre for receiving a plug, which has a smaller aperture through it. The cover is removed when it is desired to vary the weights in the cup.

The gas, after passing through the union and past the convex valve, enters the case below the diaphragm, and, when the burners are opened, is expelled by the joint action of the weighted diaphragm and its appendages, and of the atmospheric pressure exerting itself through the aperture above. When the pressure from the main becomes excessive, the convex valve is forced upwards to a greater or less extent, and the supply is therefore more or less cut off from the external case; an excess of pressure at the burners is thus avoided. On the withdrawal of the excessive pressure in the main, the normal conditions are restored. By the plug in the cover provision is made for varying the size of the aperture, and for thus adjusting the rate at which the atmosphere shall enter or be expelled from the regulator.

The claim is for—

1. The method of regulating the supply of gas in gas-regulators by atmospheric pressure acting in combination with a diaphragm and weighted cup, lead, or other appliances mounted on and connected to a valve-rod, substantially as hereinbefore described.

2. The construction of gas-regulators, as hereinbefore described.

1412.—Alexander Angus Croll, of Coleman Street, London, engineer, for "*Improvements in the purification of gas.*" Patent dated June 8, 1860.

The improvements consist in the use of shale or spent shale, or other aluminous matter, combined or saturated with sulphuric acid, and placed in dry-lime purifiers, in the purification of gas. The means adopted are the following:—Alum shale is taken, and when it has been roasted as for the manufacture of alum, it is mixed in a dry state with sulphuric acid, and by preference in about equal proportions thereof, the sulphuric acid used containing say 80 per cent. or thereabouts, of the oil of vitriol of commerce. In obtaining the combination, the dry shale is mixed, as stated, in about an equal quantity of sulphuric acid, at a temperature of about 220° Fahr. It is, however, desirable, in adding the acid, that care should be taken thoroughly to mix it and the shale together until the acid has cooled down, so as to prevent their solidifying into a compact mass, otherwise the combination obtained will require to be broken up, or reduced by the action of edge-runners or other suitable means. The most suitable form of the compound is considered to be that in which it is in separate granules or portions of about the size of peas. The compound thus obtained is placed in apparatus of the character of those generally known as dry-lime purifiers, and the gas to be purified is to be passed through such purifiers, so as to be thoroughly acted upon by the composition; and such material is continued to be used until, by testing the gas after passing it through such purifying material, it is found that the material has become spent. As a test, turmeric or reddened litmus-paper is used, as is well understood. A similar effect may also be obtained by using pipe-clay as prepared for the manufacture of alum, and treating it by sulphuric acid, as above stated in relation to shale. A beneficial effect may also be obtained by using the spent shale which has been employed in the manufacture of alum.

The patentee does not confine himself to the precise proportions stated, nor does he claim the use of alum or sulphate of alumina when either is used by itself, but what he claims is, the use of shale or spent shale, or other aluminous matter combined or saturated with sulphuric acid in the purification of gas substantially, as explained.

1418.—William Richardson, of 2, Moreton Place, Kentish Town Road, Middlesex, C.E., for "*An improved method of joining and fixing together drain, water, or gas-pipes made of burnt clay or other earthy vegetable or mineral matter, thereby rendering them air and water tight and preventing leakage.*" Provisional protection only obtained. Dated June 8, 1860.

These improvements consist of fastening and joining together of drain, water, or gas-pipes, composed of burnt clay or other earthy vegetable or mineral matter, and made in sections or parts with rims or flanches—sometimes called "flanges"—such flanges being perforated so as to receive pegs or pins of wood, or any other material or materials that will securely fasten the joints to make the same air and water tight and prevent leakage, such fastening or jointing together being made by such pegs or pins; and between each pipe or joint is placed a packing of felt, cement, or any other material applicable to the purpose. Any size of pipe can be used and secured by this invention from leakage, and pipes of any section can be securely made air or water tight, thereby overcoming the difficulty and objection to the use of pipes of the before-mentioned materials by consequence of leakage.

PROVISIONAL PROTECTION

HAS BEEN GRANTED FOR THE UNDERMENTIONED INVENTIONS.

2075.—Frederick Crace Calvert, of Manchester, Professor of Chemistry, for "*Collecting and saving certain products given off or emitted during the manufacture of coke.*" Aug. 28, 1860.

2826.—George Glover, of 8, Queen Square, London, for "*Improvements in apparatus used in measuring gas.*" Nov. 16, 1860.

2875.—Charles Humphrey and Charles Humphrey the younger, both of Wareham, in the co. of Dorset, oil and candle manufacturers, for "*Improvements in distilling coal and peat and bituminous and coaly minerals, and in the treatment of the products therefrom.*" Nov. 23, 1860.

2882.—William Renwick Bowditch, of St. Andrew's, Wakefield, York, clerk, for "*Improvements in the purification of coal gas and of coal oils.*" Nov. 24, 1860.

2910.—Vincent Wanostrocht, of Parkstone, near Poole, Dorset, for "*An improvement in the manufacture of mineral tar.*" Nov. 27, 1860.

NOTICE HAS BEEN GIVEN OF INTENTION TO PROCEED WITH THE UNDERMENTIONED INVENTIONS.

1790.—William Brunner, of Printing-House Square, London, and William Hall Levett, of Clare Street, Lincoln's Inn Fields, London, for "*An improved apparatus for increasing the illuminating power of coal gas; also, for economizing the consumption thereof, and for regulating the pressure from street mains.*" July 24, 1860.

1915.—Richard Archibald Brooman, of 166, Fleet Street, London, patent agent, for "*Improvements in apparatus for burning gas in carriages, ships, and other moving structures.*" A communication. Aug. 8, 1860.

Legal Intelligence.

COURT OF QUEEN'S BENCH.

Guildhall, Friday, Dec. 14.

(*Before Lord Chief Justice* Cockburn, *and a Special Jury.*)

BLENKIRON AND ANOTHER *v.* GREAT CENTRAL GAS COMPANY.

Mr. Hawkins, Q.C., Mr. Karslake, Mr. Giffard, and Mr. Pollock appeared for the plaintiffs; and Mr. Bovill, Q.C., Mr. Lush, Q.C., Mr. D. D. Keane, and Mr. Malcolm for the defendants.

The declaration alleged that the defendants were engaged in laying on gas to premises contiguous to the premises of the plaintiffs, and that the defendants, or their servants, so negligently, carelessly, and improperly conducted themselves in so doing that the gas escaped from their main, became ignited, and exploded; that the premises contiguous were set on fire, and that by the flames therefrom the premises of the plaintiffs were also set on fire, and damage occasioned. There was a second count alleging that the plaintiffs wrongfully exploded and set on fire a large quantity of gas near the plaintiffs premises, whereby the said premises were set on fire. The damages were laid at £30,000. The defendants pleaded "Not guilty," and that they were not engaged in supplying gas to the premises contiguous to those of the plaintiffs. The circumstances of the explosion, out of which this action arose, were inquired into by the coroner for the City of London on the 16th of March last, and fully reported in the Journal of Gas Lighting on the 27th of that month.

Mr. Hawkins, in opening the case, said he had the honour to appear, with his learned friends, on behalf of Messrs. Blenkiron, who were warehousemen, carrying on business at No. 123, Wood Street, and who brought this action against the Great Central Gas Company, to recover damages which, perhaps, it would not be necessary to go into the details of, but which amounted to between £20,000 and £22,000, occasioned by the negligence of the servants of the company during the time they were engaged in laying on gas to the adjoining premises of Mr. Morley. It appeared that, until the month of February last, Mr. Morley had been supplied with gas by the Chartered Gas Company, and that he had had no reason to find fault with the supply of gas by that company. Some short time before the day in question, a Mr. Cheesman, a collector in the service of the Great Central Company, made an application to Mr. Morley, for the purpose of inducing him to change from the one company to the other. The proposition was acceded to, and, in the course of a day or two afterwards, Mr. Cheesman came down, took account of the number of lights which would require to be supplied, and the company's inspector subsequently came down for the same purpose. It was stated by these officers that care would be taken by the company to have the matter properly attended to, and that Mr. Morley need take no trouble in reference to the subject. On the morning of the 27th of February, between eight and nine o'clock, two men, named Bicknell and Allen, servants in the employ of the defendants, came down to Mr. Morley's premises to lay on the gas. It appeared that the main of the Chartered Company ran through the centre of Wood Street, and the main of the Central Company ran along the foot-pavement on the same side as Mr. Morley's premises. The distance of the latter from the external wall of the house was about 3 feet, and the service-pipe of the Chartered Company passed under that main, and through a hole into the basement story. In order to effect a communication between the Great Central main and the premises, for the purpose of superseding the Chartered Company in the supply of gas, it was decided to enlarge that hole to the extent of 14 inches one way and 8 inches another. Having done that, the men proceeded to form a trench from that hole towards the main of the Central Company, and then to make a hole in that main in order to admit of the insertion of a 1¼-inch service-pipe. Before the men commenced their work, they went into the basement part of the premises, where some of Mr. Morley's men were engaged, and where three or four gas lights were then burning. They asked these men whether it was necessary to have the burners alight, and were told that it was essential for the purpose of their business; upon which they said "Very well," and made no further request, but proceeded to lay on the service-pipe to connect the defendants main with the house. This main was 3 inches in diameter, and the service-pipe to be laid on was 1½ inch. He (Mr. Hawkins) was told that it was a very common and constant practice, and one which, if adopted, rendered it impossible that there should be an escape of gas, to do what was called "bladdering the main." This was effected by cutting a hole in the main on either side of the place where the service was to go in, and to insert a bladder in each which, when inflated, stopped the passage through the main, and prevented any escape. By this operation, there was no interference with the supply of gas to the houses on either side, because there were other communications in the main by which it could reach them. If this precaution had been adopted by the persons sent to perform this work on the morning of the 27th of February last, no accident could have occurred. They, however, did not do so; but, having made the hole in the wall, they proceeded to dig the trench, and then to make a hole in the main of 1½ inch in diameter. The consequence was, that no sooner did they tap the pipe, than a large escape of gas took place, which communicated through the trench they had formed, and through the open windows into the basement, the result being a most terrific explosion. The whole house took fire; and not only were the premises to which the gas was to be supplied consumed,

but Messrs. Blenkiron's premises also; and, in the short space of an hour, property to the extent of no less than £50,000 or £60,000 was destroyed. This was a simple outline of the case, as it would be presented on the part of the plaintiffs. He would not trouble the jury by going with any minuteness into the details, because they would have to hear them from the witnesses; his duty was briefly to tell them what was the cause of action, and how the plaintiffs intended to put their case. The plaintiffs charged the company with negligence, and the nature of the charge was this: They said, "You were engaged in laying on gas to the premises of Messrs. Morley, and the parties who were employed for the purpose were guilty of negligence in doing that work, and their negligence consisted in this, that they did not, as they ought to have done, take due and proper care to prevent the escape of gas into the premises of Messrs. Morley, where there were lights burning, and, consequently, danger; and the result of that negligence was, that the gas escaped into those premises, an explosion took place, and damage to the extent referred to was caused." With regard to the amount of the plaintiffs damages, he (Mr. Hawkins) had mentioned that it was between £20,000 and £22,000, but that amount would be reduced by £4000 for salvage. Messrs. Blenkiron were insured in the Sun Fire Office for the sum of £19,000; and, by an arrangement with that office, the sum of £14,000 had been paid to them in respect of their claim on that policy. The reason of the difference in the amount would be explained to the jury if necessary; and this action was brought to recover that sum and the balance between the amount which had been allowed to them by the Sun Fire Office and the amount of damage they had sustained. With respect to the sum which had actually been paid to them, they of course held it in trust for the office from whom they received it. The gas company would have no right to shelter themselves under the plea that the plaintiff was insured; they could not do so in point of law, but the fire office which had insured Mr. Blenkiron had the right to say, "this was a case of damage arising from the negligence of the Great Central Gas Company; you bring your action against them for it, and of course you must hold that money as trustees for us," which was fair and equitable. With regard to the amount of damage, which was a very large sum, he did not propose to trouble the jury with it at all. There was a large quantity of stock destroyed, and the premises, of which the plaintiffs were leaseholders, were injured to a considerable extent; and if there should be any difficulty in establishing the amount of damage in the course of the inquiry, it might be that a convenient mode of settling it would be to refer it to some gentlemen out of court. He should be able to prove it, if necessary, by witnesses; and he trusted the result would be that the jury would say the plaintiffs were entitled to the amount for which they had brought their action.

Mr. LUSH said he should have no objection to the amount of damages being referred.

Lord Chief Justice COCKBURN: The more convenient course to-day will be to confine our attention to the question of liability, and if that is established, to refer the question of damages to some gentleman at the bar, with an opportunity of bringing before the court the principle upon which the damages should be assessed.

Mr. LUSH: I think so; it would be almost impossible to ascertain it here.

The following evidence was then called:—

Mr. *James Morley*, examined by Mr. KARSLAKE.

I am the father of Mr. John Lee Morley, who occupied the premises, No. 122, Wood Street, and carried on the business of warehouseman there, formerly under the firm of Keene and Co., but latterly in his own name. Before the 27th of February last, the Chartered Gas Company supplied the premises with gas. I had been acquainted with Mr. Cheesman, one of the officers of the Great Central Company, and he had frequently made application to me about a change in the supply of gas to the company of which he was the collector. I spoke to my son in consequence of those applications, and, meeting Mr. Cheesman accidentally in Wood Street, I introduced him to my son, when an arrangement took place that the alteration should be made, and the gas of the Great Central Company substituted for that of the Chartered Company. Cheesman said he would attend to it, and that we had no occasion to take any trouble in the matter. He afterwards called and took the number of the burners, and the inspector also called on the following morning and inquired the number. I believe it was about thirty-five. He said that was quite sufficient, he should not go and count them, and that he would attend to it.

John Locke, examined by Mr. KARSLAKE.

I am a porter in the employ of Mr. John Lee Morley. He is now in business at No. 28, St. Paul's Churchyard, as a warehouseman. I was with him when carrying on business in Wood Street. On the 27th of February, I got to the warehouse about a quarter to eight in the morning. My duty was confined chiefly to the basement floor, which was used for warehouse purposes. There were several floors in the house, which was a very high one. On that day, there were lights burning in the basement. It was the custom to keep them alight all day, for the purpose of working. The supply of gas was from the Chartered Company. I saw Bicknell come that morning, for the purpose of making some alteration. That was about half-past eight. I do not think Allen was with him when he first came. He came down into the basement to look at the meter, and after he had done so he asked me if I could spare the lights.

By the JUDGE: I should think by "sparing" them he meant whether I could do without them. I said we worked by them.

By Mr. KARSLAKE: That was all I saw him do then. I heard a hammering outside, and the next I heard was an explosion. Before that, I saw there had been some bricks worked out where the pipe went. That was about three quarters of an hour after I had the conversation with Bicknell. There were windows in the basement which were used as a place to take in goods. They were open on that morning. I did not see the men at work at the brickwork; I only saw the hole when it was made. Close by that hole was the meter of the Chartered Company. I did not see anything of any work done in the street. While I was in the basement, I noticed a slight smell of gas, which then became very strong, and immediately after that followed an explosion. It blew the basement all up and the floor of the warehouse immediately. The whole place was in flames at once. I was in the basement, and got out that way. The house was burnt, and the house next door.

Cross-examined by Mr. LUSH: It was my duty to light the gas in the morning. I lighted it that morning. We had five burners in the basement altogether—I mean single burners. Some came from the wall, and some from the ceiling. I had three alight. It is the duty of the locker-up—Mr. Jeffrey—to turn off the gas at night. I went through the warehouse in the morning to get into the basement There were two lights burning up stairs on the ground-floor. I did not light them. I cannot tell how far the basement extends backwards from the front. I should think not 70 feet. The staircase leading from the basement to the ground-floor was at the further end from the street. The three burners lighted that morning were at different parts of the basement. There was one near the street, one about the middle of the basement, and one further on. There was a way down from the street ot the basement, with an iron grating over it, which was always closed. We could not open it. The window was open. I opened it when I first went; it was part of my duty. It is always kept open in the day time. The grating was on the level of the pavement, and people walked over it. We had a lift there, by which goods were let down into the basement. There were several persons down there besides me that morning. Mr. Swann, the warehouseman, was there. I do not know whether Mr. Vinson was there. I was the only person down there at the time of the explosion. It was about half-past eight when Bicknell came to me first. The explosion took place as near as possible to eleven o'clock. I did not go outside previously to see what the men were doing. The meter of the Chartered Company was against the wall. I did not see whether the pipe of the Central Company was to come in a considerable distance above that of the Chartered. I made my escape as soon as possible after the explosion. I first smelt the gas at half-past ten.

By the Judge: I first went into the basement about eight o'clock; I did not then remain more than four minutes, and I went down there again about half past ten.

By Mr. LUSH: There was no one in the basement that I am aware of all that time. I had been taking goods from the ground-floor to the top of the house. The explosion took place about a quarter of an hour afterwards.

By the JUDGE: When I went down into the basement at half past ten, I did not smell the gas much. The man first asked whether I could spare the lights at half past eight; I was then in the basement.

By Mr. LUSH: I went to the premises at a quarter to eight, but did not go into the basement till half past eight. I had my breakfast first. I had just lighted the lamps when the man came down. When he asked me if I could spare them, I understood him to mean whether I could put them out. I did not put them out, and when I went down at half past ten they were still burning, and so they remained until the explosion. I did not smell gas at all while I was employed on the ground-floor. [A plan of the basement story of the house was handed to witness for him to mark on it the position of the burners he had spoken of. Having done so, he said): There were only four burners in the basement; I thought there were five. I lighted three that morning. The one which I did not light was behind the hydraulic press. I had been in the basement as late as 6 or half past 6 on the night before. Bicknell told me he had come to lay on fresh gas. I should think the Chartered pipe came in at about a foot from the ceiling: the meter was close by it, and the pipes ran along the ceiling to supply the lights. I was on the ground-floor when I heard the hammering; it seemed to proceed from the outside.

Re-examined by Mr. KARSLAKE: There was an area outside the basement. When I went down the second time, about half past ten, I saw that the hole above the old pipe had been enlarged. There was no smell of gas when I went down early in the morning. The communication between the basement and the ground-floor is by a wide staircase, and there is no door between the two.

By the JUDGE: The man asked me whether I could spare the lights, and I told him we worked by them. At that time we were in the basement. He left first, and when he left, the lights were still burning. That was all that passed between us. When he asked if we could spare the lights, he said he had come to put on a service of gas. When he came down stairs, he asked me to show him the meter, and afterwards he told me he had come to lay on a service of gas. I did not say I would or would not put out the lights; I merely said we work by them. He made no observation whatever to that, and nothing else was said. I went away directly; he left first.

Mr. *Joseph Sorrell*, examined by Mr. KARSLAKE.

I am in the employment of Mr. Freeman, architect and surveyor. I made a survey of the gas arrangements of the house, 122, Wood Street, after the fire. The main of the Great Central Company is 3 feet 1 inch from the wall of those premises, and the wall itself is 2 feet 6 inches thick by my scale, but I did not mark it. I first saw the place a few days after the fire. The hole in the wall, through which the pipe had passed was 14 inches by 8 extending through into the basement story. It appeared to be an old aperture, but then it was after the explosion. The Chartered Company's main is in the middle of the street, 8 feet 6 inches from the house. The depth of the central main from the pavement is about 1 5/8th foot.

Cross-examined by Mr. BOVILL: The top of the main is about 9 inches below the surface of the pavement. I do not know the depth of the Chartered main. When I saw the hole in the wall, there was rubbish in it; I presume the pipe had been blown out. I saw the pipe in the hands of Mr. Braidwood; it evidently fitted on the joint. I did not see the meter of the Chartered Company; my attention was not called to it.

Mr. *John Vinson*, examined by Mr. GIFFARD.

I am in the employment of Messrs. Morley, and was so in February last. I got to the warehouse on the morning of the explosion about ten minutes to nine o'clock, when I saw that some men were engaged in taking up the paving stones in front. I went into the warehouse and remained there till about ten o'clock. I then went out into the street and spoke to the two men who were at work.

Lord Chief Justice COCKBURN: Did you go out purposely, or were you going out casually?

Witness: I was going out. I spoke to the men; they were then preparing the pipe. They were cutting the pipe. At that time I smelt the gas. I said to the man that the gas smelt rather strong. The man replied, that it was rather strong. Nothing more was said. I then went on as far as Cheapside, and returned to the warehouse, after which I went to Mitre Court. When I came back from there, I heard the explosion. I was turning out of the court when I heard it. I saw a flame at the place where the men had been cutting the pipe; the flame was going towards the building. I looked in at the warehouse; the floor was blown up, and it was burning.

Cross-examined by Mr. BOVILL: The first time I smelt the gas that morning was was about 10 o'clock. I was going towards the front door when I smelt it. That was about 35 minutes before the explosion. It was a good distance from the door where I smelt the gas, near the staircase leading from the basement, and I continued to smell it as I went towards the door. The hydraulic press is facing that staircase and not very far from the bottom of it. I do not know how many gas-burners there were in the basement. When I spoke to the men as I left the warehouse 35 minutes before the explosion, they were at work chipping the main with a chisel and hammer. I was on the opposite side of the way when I heard the explosion. I heard only one. When I got up to the door, I found the gas issuing from the main which was alight; that was after the explosion. The flame

was going in the direction of the house, but did not extend so far. A few seconds after the explosion, flame and fire issued out of the house.

Mr. BOVILL: Quite far enough to ignite the gas issuing out of this pipe?

Witness: No.

Mr. BOVILL: You have no means of knowing or suspecting how the gas could get alight, except by the explosion?

Witness: No.

Mr. *Wm. Jeffrey*, examined by Mr. HAWKINS.

I was in the employ of Mr. Morley on the 27th of February last. My duty was to turn off the gas at night; to see that the burners were turned off, and also that the gas was turned off at the meter. I did that duty on the Saturday night before the explosion, and there was no gas used on the Sunday. I got to the premises at about half-past seven, or a quarter to eight, on the Monday morning. My business was not in the basement story, but on the ground-floor just over it. I did not smell any escape of gas at that time, nor before the explosion. I did not see the men at work.

Cross-examined by Mr. BOVILL: When I turned off the gas on the Saturday night, I saw to all the jets but one, which was at the top of the stairs. I then turned off the meter, and afterwards the remaining jet, which was in the warehouse above the stairs.

Lord Chief Justice COCKBURN: As I understand it, the stairs came up from the basement through an open space without a door, so that the jet would be on the ground-floor?

Witness: Yes, from the ceiling.

Cross-examination continued: The opening of the staircase from the front of the warehouse on the ground-floor was as far as from me as to the wall of the court; it was at the back of the warehouse, the furthest from the street. I cannot say how many lights I turned off on Saturday night. I believe there were four lights in the basement. I cannot mark their position on the plan. There was one near the front; that was in the water-closet. There were two others about a third of the depth of the basement from the front, one on each side of the press.

By the JUDGE: The burner in the closet did not give any light in the warehouse. There were three besides that. They were kept alight all through the day, including the one in the closet.

By Mr. BOVILL: The fourth light was a little further back than the press —there was one behind the press, and one a little further. I did not light the gas on Monday morning; John Locke did that. According to the ordinary course of things, all these four burners were kept alight all day till they were turned off in the evening. It was not the duty of anyone else to turn off the gas except myself. If the gas is turned off at the meter, it would put out the other light.

William Swanton, an officer of the fire brigade, was next examined, and gave similar evidence to that given by him before the coroner as to the state of the premises when he arrived with his engine on the morning of the explosion.

Lord Chief Justice COCKBURN: I do not quite understand, Mr. Hawkins, how you say that the gas from the defendants main, when the hole was made into it by their servants, got from there into the house. You do not say that there was a service-pipe laid on.

Mr. HAWKINS: No, my lord, there was a slight trench dug from the main to the hole which had been made in the wall for the purpose of admitting the service-pipe, and when the hole was made in the main, the gas flowed along the trench and through the hole in the wall, the main being only three feet from it. There was also an open door or window into the basement. We say that in this way, or through the hole in the wall, the gas entered, and in that way the explosion took place.

A JURYMAN: The trench was quite open at the time.

Mr. HAWKINS: Yes; quite so, but there was a great pressure of gas from the gasometer.

Mr. *Alfred Upward*, examined by Mr. HAWKINS.

I am the superintendent of the Brick Lane station of the Chartered Company. Our company had supplied the premises of Messrs. Morley with gas before the 27th of February last, and on that morning I learnt that the supply of gas to them was to be discontinued, and I went down to the premises to see Mr. Morley on the subject. [Witness related the circumstances which came under his observation in reference to the defendants workmen and the explosion which took place while he was in the house, as deposed to, by him before the coroner.]

Mr. HAWKINS: In laying on a service-pipe of the dimensions we have heard—an inch-and-a-half service in a three-inch main, in the position of the Central Company's main, three feet from the house—what would be the proper course to pursue?

Witness: For that sized service, I should certainly have bladdered it off each side of Messrs. Morley's premises, cut the main out, and laid in a cast-iron branch—a kind of T-piece. Considering that it was only a three-inch main, I think it was a large hole to make so near the house. I do not suppose it is more than two feet or two feet six from the house.

Lord Chief Justice COCKBURN: Perhaps you will be so good, Mr. Hawkins, as to let him have the pipe for a moment, and he will explain what he means by bladdering off. [Pipe handed to witness.] Supposing that to be the main, and you are going to make a hole to insert a service-pipe, what should you do?

Witness: As the main is so small, and the service comparatively so large, I should have cut a piece out here, and have inserted a T-piece, and have bladdered it off to keep the gas from the space I was acting upon. The bladders go in here, and being blown out, they stop the supply of gas between the two.

Lord Chief Justice COCKBURN: Is that the course usually adopted in such cases?

Witness: It is not always adopted; certainly not; but this being so near the house, I should have done it.

Lord Chief Justice COCKBURN: The bladder is occasionally used?

Witness: Yes.

Lord Chief Justice COCKBURN: It is not an idea of your own for the first time?

Witness: No; every gasman knows what it is.

Lord Chief Justice COCKBURN: Under what circumstances have you used bladders?

Witness: When we have to lay in a large supply, a branch of this kind is inserted.

Lord Chief Justice COCKBURN: Is that a sort of precautionary measure, well understood in the gas supply business?

Witness: Yes; quite.

Lord Chief Justice COCKBURN: In cases where you anticipate any possibility of danger?

Witness: In cases where the main is so exceedingly near the house, and is of small diameter, I should certainly take that precaution.

Lord Chief Justice COCKBURN: The purpose of my inquiry is not so much directed to what you might do as a matter of extraordinary caution on your own behalf, as whether it is a course usually resorted to in similar circumstances?

Witness: Not for service-pipes. I believe I was asked how *I* should have acted in the matter. As the main was only 2 feet from the house, I should certainly have taken that precaution.

Lord Chief Justice COCKBURN: But what I want is, not so much to ask what you yourself individually would have done, but whether this is one of those precautionary measures that persons conversant with this department of business would resort to?

Witness: We have frequently done it; the Chartered Company have frequently done it.

Lord Chief Justice COCKBURN: That is all you can say?

Witness: That is all I can say.

A JURYMAN: But do you invariably do it—say in 18 cases out of 20?

Witness: We do not.

Lord Chief Justice COCKBURN: But the question would have reference to a given state of circumstances; that is, where you have a main so near a house as this is?

Witness: A comparatively large service in a small main?

Lord Chief Justice COCKBURN: Yes. Your company does it so?

Witness: I cannot say that in all cases we have done it, but in many instances.

Mr. HAWKINS: Would it be necessary, at all events, where lights are burning in the basement so close as this, to take some precaution to prevent an escape of gas? Take, for instance, a case in which there are lights burning in the basement to which the supply is to be communicated; is it usual in cases of that sort to prevent the escape of gas by bladdering off or otherwise?

Witness: I should have done so; whether the men who went to do the job would have taken that precaution, I do not know.

Mr. HAWKINS: At all events, in your judgment, is that a precaution which ought to be taken?

Witness: I should have taken that precaution.

Examination continued: The main is supplied at both ends, I believe, and it would not interfere with the supply of gas to other houses if this space were bladdered off. It is common to the mains of all companies that they have a communication at both ends.

A JURYMAN: Ought not your service-pipe to have been removed before the other was admitted.

Witness: We received no notice of it.

Lord Chief Justice COCKBURN: That is not the question. The question is whether they ought not to have waited till your main was removed?

Witness: There is no positive necessity for it; I think they ought to have told us.

Lord Chief Justice COCKBURN: That may be, as a matter of courtesy to you; but as a matter of precaution for the safety of the premises, ought not the service to have been moved, or the connexion severed, before their service-pipe was put in?

Witness: I do not think it affects the case at all, my lord; we frequently receive notice afterwards, and then we go and cut it off from the street and plug it up.

Examination continued: Of course if the main had been properly bladdered off, it would have been impossible for any gas to escape. It is very difficult for me to say where the explosion took place. It was not on the stairs, for I was going up at the time to speak to Mr. Morley, and I was not burnt. From the effects, I should say it was from below, from the basement. I did not leave the premises until our supply was cut off. I could not get inside the house after I once made my escape, but I could see the state of our pipe from the street, through the little grating. It was then connected with the meter, as far as I could see, but it was not long before it was entirely burnt, and then the gas was on fire. A very few minutes elapsed before it ignited.

By the JUDGE: When I first made my escape from the premises, I saw no flame proceeding from our service-pipe. I should imagine the explosion did not have the effect of disconnecting our service-pipe from the branch which supplied the different burners, but I could not get into the premises to see. I think I should have seen if it had been so. I saw the corner of our meter through the grating. At that time the meter was intact, but I could not see whether the connexions were gone. As soon as our meter got on fire, the service became lighted, and of course gas got into the building.

By Mr. HAWKINS: The meter is made of tin, and the connexion between that and the service is lead, which would quickly melt. At that time, the whole of the house was on fire, and I saw a flame of gas from the hole that had been cut in the Central Company's main. It was issuing into the house from one of those openings. That was immediately after I descended into the street, and then our meter and pipe were not burnt. To the best of my recollection the flame was going through the area and basement, so near to the hole that I do not suppose there were more than 9 or 10 inches between them; but it was in a great hurry, and I could not positively say whether it was through the area or the hole, but I saw most distinctly that the flame was issuing into the house. I traced it from the Central main.

By the JUDGE: It reached into the house; I saw the flame behind the wall.

By Mr. HAWKINS: At that time there would be a considerable pressure from the gasometer upon the main, which would have a tendency to force the gas into the house. I assisted one of the Messrs. Morley in stopping the flow of gas from the Central main; we did it with mud.

Cross-examined by Mr. BOVILL: There is a great deal of opposition between our company and the Great Central. There has been a strong feeling on their parts to get our customers away, and on ours to keep them. In putting in a service-pipe, some layers first mark the opening round with chalk, and some do not. It may be a common mode to do it in that way. It is generally done by cutting a hole with a driving point. I do not believe the outline of the hole is always first marked with chalk, but I will not positively say.

Lord Chief Justice COCKBURN: They make a hole somehow, Mr. Bovill.

Mr. BOVILL: My lord, you will find this is not so immaterial as your lordship supposes. Your lordship will take that from me.

Lord Chief Justice COCKBURN: I take it that he knows nothing about it.

Mr. BOVILL: Your lordship will give me credit for only asking him certain questions. I have no desire to waste time.

Lord Chief Justice COCKBURN: Up to this moment no time has been lost.

Cross-examination continued: When I got to the premises, there was a hole made in the main. The men were then using some tool. I cannot say whether it was a rymer or a tap; but neither of them was in the hole when I spoke to them. I did not see them break the hole; it was done before I got there. I cannot say positively what was the width of the open-

ing; I believe one flag-stone was taken up. I believe the hole through which the Central service was to go was the same as that through which ours passed. I think they were going to follow our service. I do not know about the levels—whether it would come to the very place where our meter was. I saw that the brick-work was fresh cut; I did not see the man cut it away. From the time I left the trench to the time I went up stairs and the explosion took place, was not a minute. I saw no reason to apprehend any danger, or I certainly should not have gone up.

Lord Chief Justice COCKBURN: Did you smell any gas?

Witness: I did not, my lord.

Cross-examination continued: The gas being invisible, I did not see any issuing from the pipe. I had only got up two or three steps when the explosion occurred. I had not reached the first floor.

Lord Chief Justice COCKBURN: You were going to explode when you got up there.

Cross-examination continued: I was blown down by the explosion. I lost my legs for a moment. If I had been going to put in so large a service so near the house, I should have cut out a piece of the main, and inserted a branch or T-piece, and doing that I should have used badders at the ends of the separated main. That is all that I wish to convey by my evidence in chief on that one point. The T-piece is about 3 feet or 3 feet 6 inches in length. In putting in a T-piece, it is the ordinary and common method to use bladders, to prevent the escape of gas. In putting in a service-pipe only, it is the practice not to use bladders. I never knew an instance of that kind, in which the main was bladdered, and I never knew of an accident from not doing so. I had no reason to suppose that in this case, the men had used bladders. I did not smell the gas, and I went into the house at a few yards distance feeling perfectly secure. Of course, I had no apprehension in my mind. I cannot say whether our company had another service into the house; I saw but one. It is unusual that there should be a second, but in exceptional cases there may be more than one. [The witness was cross-examined at some length as to the position in which he stood, when he saw the meter of the Chartered Company, as deposed to in his examination in chief.] I distinctly saw the Central Company's gas on fire, and ours was not. Our main was some distance off in the street; it is a ten inch main, three or four times the area of the defendants main, but with less pressure.

Mr. BOVILL: I will not ask you which is the best gas.

Re examined by Mr. HAWKINS: In my judgment, it would have been the more prudent course in laying in this service to insert a T-piece. We have inserted service-pipes like this without it.

Lord Chief Justice COCKBURN: I understand the witness to say that it depends upon the relative position of the main. If he were putting in a large service close to the premises, he would not do it without a T-piece being inserted, and with a T-piece it would be necessary to bladder.

Mr. BOVILL: On that we both agree.

Lord Chief Justice COCKBURN: That is, wherever it is necessary to bladder you must put in a T-piece; but wherever you do not put in a T-piece, you do not bladder. He does not say that you not having put in a T-piece ought to have bladdered; but you ought to have put in a T-piece in order to bladder it, and that it was dangerous to do it without a T-piece.

Mr. *R. Atkinson*, a gentleman engaged in the adjacent premises to Messrs. Morley, and Mr. *Braidwood*, the superintendent of the London Fire Brigade, gave similar evidence to that which they gave before the coroner at the inquest.

Mr. *John Fretwell*, examined by Mr. HAWKINS.

I am a warehouseman in Goldsmith Street, which is about 80 yards from the premises in question. I was at Messrs. Morley's premises a few minutes before the explosion took place. As I was leaving, I saw the men belonging to the Central Company outside. One sat with his back towards the street, with a chisel and hammer in his hand; the other stood upon the pavement, doing nothing. Neither of them were doing anything; they were having a sort of pause in their work. Inside the premises there was a very bad smell, which attracted my attention; the gas was very offensive. As I came out, I spoke to the men.

Lord Chief Justice COCKBURN: Where was it there was a very bad smell?

Witness: Inside the warehouse. I had been up to the first floor. I did not smell the gas there, nor did I find it on going up. I smelt it on entering the premises, but not further up. As I came back from the first floor, it was very much worse.

By Mr. HAWKINS: When I came out again, I saw the men of the Central Company in the position I have stated, and said, "My good men, you will poison the people inside," and went away immediately. I did not observe the hole for laying in the service-pipe. I did not wait for the reply of the men; I went straight away from them to my own premises. As I got within my own door, I heard the explosion; it was within a minute, I should say.

Cross-examined by Mr. BOVILL: I cannot remember whether, in going down the staircase, I smelt the gas there. It certainly was much milder if I smelt it there at all.

Mr. HAWKINS: That is the plaintiffs case.

A JURYMAN: Did I understand from the last witness that he did not smell the gas outside the house?

Lord Chief Justice COCKBURN: He smelt it both inside and out on coming down stairs; but the substance of his last answer was, that he could not say whether he smelt it on the staircase going in or out. [To witness]: I think you said you smelt the gas inside and out, but when you got down on the ground-floor it was much worse than when you went in?

Witness: Yes.

Lord Chief Justice COCKBURN: How long were you there?

Witness: Not more than a couple of minutes. I simply asked a question, and came out immediately.

Mr. *Upward*, recalled.

Lord Chief Justice COCKBURN: You are acquainted with the consumption of gas. These burners which they had at Mr. Morley's premises—do you know the size of them and the quantity of gas they consumed?

Witness: They generally are made to consume something like 5 cubic feet per hour; that is about the largest consumption.

Lord Chief Baron COCKBURN: Well now, supposing one of these had been left open—had not been properly turned off on the Saturday night, and the gas had been turned on at the meter on Monday morning, how long would it take from a jet or burner of that size to produce a sufficient quantity of gas to escape and cause an explosion, and the destruction of this property?

Witness: That would be very difficult to say. The mixture which is of the greatest explosive form is about 1/9th of gas and 8/9ths of air.

Mr. BOVILL: That is the most explosive?

Witness: Yes; there are explosive mixtures less than that.

Lord Chief Justice COCKBURN: Can you give one an idea of the length of time required, in a place like that down-stairs warehouse, to supply that 1/9th of gas to mix with the 8/9ths of atmospheric air?

Witness: I really could not, my lord. I do not even know the size of the premises.

Lord Chief Justice COCKBURN: In how long a time would that take place if the gas were escaping from such a hole as that which we have seen in the defendants main, along a trench, to the service-pipe hole?

Witness: I should say very rapidly. The quantity would be very large. The air in the house being much more rarefied than outside, it would naturally draw the gas, mixed with the cold air, into the hole.

Lord Chief Justice COCKBURN: Then it would take a comparatively small time for gas going in mixed with this atmospheric air to get into an explosive condition?

Witness: I think it would.

Lord Chief Justice COCKBURN: But you cannot give any one an idea how long a time really if the gas escaped from a common burner it would take to fill that room with the necessary quantity of gas, mixed with air, to produce such an effect?

Witness: I have no idea of the size of the premises. It would of course vary with the draught.

Lord Chief Justice COCKBURN: That depends again, Mr. Hawkins, upon what I am afraid we have little means of ascertaining except speculatively; that is how much of the gas escaping out of that hole would find its way into the premises, because a great deal of it would necessarily escape.

Mr. HAWKINS: But I mean what quantity altogether would escape?

Lord Chief Justice COCKBURN: That would depend upon a variety of elements; in the first place, what is the pressure?

Mr. HAWKINS: No doubt it would.

Lord Chief Justice COCKBURN (to witness): Can you tell me how much per hour, or any other period of time, would escape through one of these burners?

Witness: I think about 5 cubic feet per hour or less. They vary from 2½ feet to 5 feet.

Lord Chief Justice COCKBURN: How many cubic feet of air would there be in a room of ordinary dimensions?

Witness: My lord, I have no means of knowing the size of these premises; it might be some thousands.

Lord Chief Justice COCKBURN: Have you any opinion, from a hole of the size we have seen in the main, how much would escape?

Witness: No, I have not, but it must be something considerable—some hundreds of feet or more.

Mr. BOVILL, on behalf of the defendants said, it was not often that a jury had their attention called to a case of greater importance than the present. The premises belonging to the plaintiffs were a portion of those which were destroyed on the occasion of this fire, and the question involved was one of not less than £120,000, which the gas company were sought to be made responsible for, by reason as it was said of their workmen having made a hole in the main, instead of cutting out a piece.

The LORD CHIEF JUSTICE: You must combine that with this other by no means unimportant element. You must assume that by these means gas in large quantities is let into a place where there is a light ready to ignite it. It is not merely having made the hole and letting the gas escape, but letting it escape into a place where, to the knowledge of the people whose conduct is in question, there were three gas burners alight ready to ignite it.

Mr. BOVILL said he was much obliged to his lordship. He was just giving a short outline of the case, to show that the company were sought to be made responsible for these £120,000, because on a certain morning in February last, two of their workmen, whose duty it was to put on a service did, according to the evidence of the only engineer who had been called for the plaintiffs, and he the engineer of a rival company, what they ought not to have done under the circumstances, namely, bore a hole in the main, and fit a service into it, whereas they ought to have cut out a piece of the main and have bladdered it. Now, it was not a little remarkable that this case should be presented nominally as an action by the plaintiffs on the record, when in reality the parties to the suit, who were endeavouring to obtain payment of this large amount from the gas company, were the insurance offices who undertook the risk. He did not mean to say that, if according to the statement of his learned friend, the plaintiffs had sustained any loss beyond the amount of the insurance, which was a matter to be inquired into hereafter, they would not be entitled to a verdict; but it was a matter of notoriety in the City of London, and it was for the jury to determine whether the insurance offices could throw upon the defendants the consequence of this fire. In this particular case, it was admitted that, to the extent of £14,000, it was the action of the insurance company. The jury had been informed that £14,000 had been paid, under an arrangement—whether there was any further arrangement to pay more was not known, but certainly the action was presented, to a very large amount, as a question between the insurance office and the gas company. The case of complaint made by his learned friend in opening the case was that, in laying on a service, the main had not been bladdered. Mr. Upward, in giving his evidence, said that the bladder ought to be adopted in putting in a T-piece. The jury might very well understand the reason of that. If there was a main of the size in question, and a piece 3 feet long was cut out of it for the purpose of inserting a T-piece, there would be an aperture at each end. The gas that was in the pipe would escape both ways under strong pressure, and of course the bladder was inserted to prevent that escape. No one doubted this, but when Mr. Upward came to be cross-examined, he said it was only when they inserted a T-piece.

Lord Chief Justice COCKBURN: No; you misunderstand the witness. He says you ought not to run the risk of the escape of gas which must necessarily take place unless you bladder. You can only bladder when you use a T-piece, and therefore in this case, as you ought not to have run the risk, you ought to have used a T-piece.

Mr. BOVILL: I know the evidence of the gentleman whom I am about to call, and I do not pay much attention to the evidence of a rival engineer.

Lord Chief Justice COCKBURN: You must not misrepresent him.

Mr. BOVILL said he had no desire to do so. No doubt the main might be bladdered, but then there would be three holes made instead of one. But the answer to that was, and he (Mr. Bovill) put the question to Mr. Upward in the most unhesitating manner, "Is it the usual course to put bladders when you merely make a hole in the main to insert a service?" He said, "It is not usual or ordinary." He then asked, "In the whole of your experience, did you ever know such a thing done?" He knew what the evidence was, he believed, and could confidently put the question, and the answer was, that in the whole course of gas-engineering he had never known a case when the bladder was put in when a service-pipe only was inserted. From the time when gas was introduced, now more than half a century ago, no engineer had ever dreamed of bladdering a pipe when

a service was to be inserted; and accordingly, even Mr. Upward himself, when he passed by the men at work, and with the eye of a rival engineer, who saw himself about to be supplanted, and looked very jealously upon the whole proceeding, and noticed the pipe which was to destroy the Chartered Company's business with Messrs. Morley, said, "I never supposed that they had bladdered it, nor had I the slightest apprehension of danger." Nor would it have entered into the mind of any man, even in the state of things which the learned counsel for the plaintiffs had represented. Now it was right that he (Mr. Bovill) should just state to the jury not only how the matter stood upon the evidence of the plaintiffs, but how it stood in reality upon the facts, because there was no use in discussing half the case; the whole matter would have to be laid before them, and they would then see what the position of the defendants was. But before he went to that, he would call attention to this most remarkable circumstance. On that morning, it was certainly the fact that one of the burners in the basement of those premises which, in the ordinary course of business, had never been known to be out before, was not burning. It was equally clear that long before the main of the Central was tapped there was a smell of gas in the basement story. Vinson proved that most distinctly, and there could be no mistake about it because he was a perfectly independent witness. It was also proved by the first witness, Locke, that the gas-burner behind the press was near the staircase, while they found from Vinson that the smell of gas was also near the staircase. Now this took place according to Vinson's evidence, long before the Central Company's main was tapped; it was before he went out in the morning.

Lord Chief Justice COCKBURN: No, as he was going out.

Mr. BOVILL said it was 35 minutes before the explosion, and he should show that the explosion took place within about 4 minutes of the time when the hole was tapped in the main; therefore, it would stand perfectly clear and manifest that when Vinson perceived the smell of gas in the basement story it could not come from the main of the Central Company, because Vinson had told them also that when he went out he saw the men at work; that they had made the trench and were tapping the main preparatory to knocking a hole in it. Vinson, at the time, smelt the gas; where on earth did the gas come from? Did it come from the Central Company's main? Clearly not; it could not do so,—they had no connexion with the premises—their main was not open. It was clear that it was on the premises, and there was a very remarkable circumstance indeed connected with this case. No doubt, in all cases of fire, there was a mystery; and, in consequence of that, it was that people generally insured and insurance companies took the premiums and the risk, though they desired in the present case to relieve themselves of the payment. But now what happened? They had had before them the person whose duty it was to put out the lights; and if one or two of those lights were left burning, he was very seriously implicated. He said that one burner was not put out on the Saturday night until after he had turned off the gas at the meter. He (Mr. Bovill) did not mean to say that if he had done so, and had left the burner on the staircase open, this accident would have occurred, and the only importance of the statement was to show how easily an accident might occur with gas, without persons being able to account for it. But that was not the burner which was not alight on the Monday morning, but another one; so that, first, there was an irregularity on the Saturday night with reference to one burner, and an irregularity on the Monday morning with reference to another one at the back of the warehouse, near the staircase. Whether it had not been properly turned off on the Saturday, or had gone out on the Monday, he could not say, and there was no one called to show why it was not alight on the Monday morning. Now, was there any escape of gas on Messrs. Morley's premises before the main of the defendants was tapped? That was proved to be the case, beyond all dispute, by Vinson, and also that the escape of gas could not be from the Central Company's main. Where did it come from? They could not tell. There was no explanation offered, and of course the Central Company knew nothing about it; but there it was. His learned friend did not mean to ask the jury to come to the conclusion that, before the main was tapped, there was gas coming from the iron; if not, where did it come from? Did it come from the burner in the basement which was not lighted, or from the burner on the staircase? He (Mr. Bovill) could not tell, and he submitted it to the better judgment of the jury. The fact was manifest upon their own case, and if the jury found that there was gas there, it did not lie upon the defendants to account for how it got there. That it was there was evident, otherwise Vinson could not have smelt it. If they found that gas was actually coming into the place, and an explosion occurred, the same circumstance which caused the gas in the place would account for the explosion. Let it be remembered that they had no explanation as to the condition of the other burners. There must have been an enormous consumption of gas at a place where they required an inch and a half service-pipe to the meter; and how was it possible to know where the escape took place. But the plaintiffs said, and they called an engineer to tell the jury, that the blame rested with the gas company whose pipe was not open at the time. Surely they could not be to blame for the gas which was in the premises at the time he spoke of. Then they went on to say, that afterwards and before the explosion the defendants had made a hole in their main, that the gas came out of that hole and went into Morley's premises, which caused the explosion. Their theory was, that the main of the Great Central Company being under the pavement, and the ground being excavated up to a hole through the wall of the house, the gas, instead of following the ordinary course of nature, went along the trench and into the hole, and so caused the explosion. He would enlighten the jury a little upon the facts. It was rather extraordinary that this matter having been inquired into on a former occasion, no intimation had been given to the jury with regard to the making of the trench and the hole. But he would tell them what the facts were as they would be proved in evidence. The arrangement was made that the service-pipe was to be laid on the Monday morning. He would call before them the man who had had experience all his life in laying on services, and who was desired to go with his man Allen to make the arrangement for laying on the services to Messrs. Morley's premises. They determined where it should be laid on—they saw where it was that the Chartered Company's services went into the premises, and just below the ceiling a hole was made through the wall above that service. Bicknell went there; he saw the lights burning, and of course like a careful man, who had been in the service of the defendants and other companies many years, he wished to have the lights put out. But there was a hesitancy about it, and Locke said they could not do without them. Bicknell did not leave the hole open as had been stated to the jury, and no witness had been called to prove that it was so. What he did was to make an aperture sufficiently large to admit the service-pipe of the Central Company above the service of the Chartered Company, and he then rammed in some yarn, which these men always carried with them for the purpose of stopping holes, and preventing mischief. Having done that, he proceeded to mark and chip round the place where the hole in the main was to be made, and having burst it in, was preparing the hole for the reception of the service when the explosion took place. With reference to the hole in the wall, the plaintiffs had not called a single witness to prove that it was left open; even the engineer of the rival company did not pretend to say that he could see through that hole, although, there being lights in the basement, he could easily have done so had it not been stuffed up with yarn, as would be proved by the defendants men. It certainly never entered into Mr. Upward's mind that there was the slightest danger in what these men were doing, and though he now talked of the propriety of having used a T-piece in laying on the service, it would be clearly shown by the evidence on the other side that he was the only engineer in the world who would have done so. As to the size of the hole in the wall, it was absurd to suppose that men requiring only a hole of the diameter of about 2 inches, would make one 14 by 8. He would put a witness in the box to prove how that hole came to be made so large after the explosion, for it was not a little remarkable that all the plaintiffs witnesses spoke to was the size of the hole after the explosion, and as the hole, such as it was before, was stopped up with yarn, there was no pretence for saying that the gas got in through there. This accident had attracted a great deal of attention among scientific men, who had been led to suppose, from the representations made, that there was no smell of gas upon the premises before the defendants main was tapped, although now it was established, upon the clear testimony of the plaintiffs witnesses, that there was a smell of gas in the premises before it was possible there could have been any escape from that main. Assuming, however that it was the gas of this company, the question was, how did it get there? The engineers who had considered the matter since the event, would tell the jury that the only possible way of accounting for it was to suppose that the gas coming out of the trench into the air must, contrary to all experience, have found its way down again through the grating which had been referred to, and into the open window. But they would also say that, though it was possible, they never contemplated such a thing, and therefore any charge of negligence in this respect against the servants of the defendants was most idle. The main was tapped in the ordinary and universal mode in which such things were done, and every precaution against accident was taken that could reasonably be expected. After commenting at some length on the evidence given in support of the plaintiffs case, the learned counsel cited the case of *Vaughan and the Taff Valley Railway Co.* which was tried in the Court of Exchequer. In that case, an engine belonging to the defendants proceeding along their railway no doubt set fire to certain premises belonging to the plaintiff. But they were not proved to have done anything out of the ordinary course, and it was shown that they had adopted all usual precautions, notwithstanding which, however, the accident occurred. The principle of law laid down in that case was, that if an accident did occur, it was not on that account alone, that the person doing the injury was to be made responsible. In that case, the railway company had caused the fire by a spark from their engine, but they had adopted all ordinary precautions against accident, and they were held not to be liable for the damage done. In the present instance it was not a mere question of whose gas it was, though if the plaintiff had not made out to the satisfaction of the jury, that it was the Central Company's gas which caused the explosion, the defendants would be entitled to a verdict; but, assuming it to be so, if the company had adopted all reasonable and proper precautions against the possibility of accident which experience and knowledge could suggest—and he believed they would be satisfied on this point as the case proceeded—they were not open to the charge of negligence, and could not be held responsible for the damage which had accrued.

John Bicknell and *John Allen*, the defendants workmen who were engaged in laying on the service in question, were examined and cross-examined at great length. Their evidence was substantially the same as that given by them before the coroner's jury in March last, as reported in the JOURNAL OF GAS LIGHTING of the 27th of that month.

SATURDAY, DEC. 15.

Mr. *McMillan*, examined by Mr. MALCOLM.

I am an inspector of meters in the defendants company. I know the hole in the wall of these premises through which the Chartered Gas Company's pipe went. I recollect going to the fire after the explosion had taken place, and doing something to the hole. That was between ten and eleven o'clock in the morning. The fire was raging at the time, and I found the trench which our men had made was getting full of water. To prevent our main being filled with water, I enlarged the hole into the building very considerably with a crowbar, and the water ran into the building instead of into the main.

Cross-examined by Mr. GIFFARD: I enlarged the hole from the outside. I could not get into the building. I displaced two or three bricks and could see right through the hole.

Re-examined by Mr. BOVILL: I could not see through the hole before I knocked out the bricks.

Mr. *Richard Jones*, examined by Mr. BOVILL.

I am a civil engineer, and have devoted considerable attention to the subject of gas. I am now engineer-in-chief of the Commercial Company. I am also consulting engineer to the London Company, and have been engineer to various provincial companies,—Chester, Worcester, Bath, and other places. I have had considerable experience with respect to the management of gas-works, and pipes, and mains, and everything connected with the engineering department.

Mr. BOVILL: We have heard that there was a smell of gas in their premises half an hour before the explosion took place.

Lord Chief Justice COCKBURN said that was not so; but the question could be put to the witness assuming it to be the fact.

Mr. BOVILL: Supposing there was a smell of gas on the premises before the main was tapped, was there anything in connexion with it that could have caused the smell in the warehouse?

Witness: No.

Lord Chief Justice COCKBURN: Of course if the main was not opened, the smell could not come out of the main. At the same time, does it not constantly happen that if you open the ground through which a main passes, which main is connected by service-pipes to the houses, there is a smell of gas?

Witness: That depends, also, much upon the length of time the main has been laid; in this case the main had been laid eight or nine years.

Lord Chief Justice COCKBURN: How does time affect it?

Witness: By the decay of the metal.

Lord Chief Justice COCKBURN: You mean that the longer it has been laid, the greater would be the likelihood of leakage?

Witness: Yes.

Mr. Bovill: You have heard the position of the main which is described as being about three feet from the house; also, that there were lights burning in the basement, and that the man made a trench and an opening in the wall above the Chartered Company's pipe. What would be the means he should have adopted?

Witness: He should do as I understood yesterday he did do, plug the hole; that was the proper course to adopt.

Mr. Bovill: Having stopped the hole, would there be any danger or impropriety in his breaking into the main?

Witness: There would be no impropriety, and I should conceive there could be no danger of the gas passing through the hole. There would be no possibility of gas passing through that hole.

Mr. Bovill: If you had been there yourself after the experience of now nearly a quarter of a century, should you have had any hesitation or difficulty in having the main broken through under the circumstance of the main being near the house, and lights burning in the basement?

Lord Chief Justice Cockburn: Would you have done what the man did?

Witness: I should have done what the man did.

Mr. Bovill: Taking the position of the main, the proximity to the house, and the lights burning, in your judgment as an engineer of experience, was it right to punch the hole into the pipe, or was it necessary to put in a branch with a T-piece?

Witness: I have never, in my experience, put a T-piece in a 3-inch main for 1½-inch service.

Lord Chief Justice Cockburn: By that I understand you to say you have never done it, or known it to be done?

Witness: I have never seen it done.

Mr. Bovill: According to your judgment and experience, was it right or not in putting in a service of that size, to cut a hole into a main of that size?

Witness: Yes; I have never known any other practice.

Mr. Bovill: Where you cut a hole in a pipe, is that the ordinary way which the men described of chipping and knocking it in?

Witness: That is the practice in the metropolis.

Mr. Bovill: Are they in the habit of laying on services in the day and night?

Witness: They very rarely lay on a service-pipe at night. During the course of the day it is the ordinary practice, and at all times of the year.

Mrr Bovill: Now, as regards the bladdering. I think, my lord, the evidence only goes to show that the bladder is used when a T-piece is inserted.

Lord Chief Justice Cockburn: I consider that is involved in the T-piece. If they bladder it is for the purpose of shutting off the communication from places where they are operating, in order to insert a T-piece.

Cross-examined by Mr. Giffard: The reason I should prefer to stop up the hole, would be to prevent the danger from lights burning in the basement; it would have occurred to my mind, or to the mind of any practical man, to stop up the hole in the wall, if the lights were refused to be put out. I should imagine it possible that if the gas went through the hole, it might have been dangerous. I may say there would have been danger, but it would depend very much upon the quantity of gas that would flow, and the position of the building.

Lord Chief Justice Cockburn: But you say, looking to the circumstances of the position of the main, and also looking at the circumstance that lights were burning, there would have been danger if the hole was not stopped.

Witness: I think so.

Cross-examination continued: If there had been any other opening by which the gas could reach the lights, say a window, at about the same level, if it had the same relative position to the hole in the wall, that is directly opposite to the hole in the main, there would have been the same danger. The number of cubic feet of gas per minute, which an inch and a half main would discharge, depends entirely upon the pressure. I am not exactly prepared to say what it would be; assuming the average day pressure of 10-10ths, or one inch on the main; I think it would be about 33 to 35 per minute.

A Juryman: Did I understand you to say that 33 feet of gas per minute would be discharged through a hole an inch and half in diameter?

Witness: I am inclined to think so, I am not prepared to speak accurately.

Mr. Giffard: How many cubic feet per minute would be discharged from an ordinary fish-tail burner.

Witness: There are fish-tail burners which will consume from 3 to 5 and 6 feet per hour. An ordinary fish-tail burner consumes 5 feet per hour.

Mr. Giffard: I do not know, Mr. Jones, whether you saw the premises yourself.

Witness: I did after the fire.

Mr. Giffard: Did you see the windows by the grating?

Witness: The windows by the grating were destroyed. I saw the apertures where they had been.

Lord Chief Justice Cockburn: Did you see the grating, or was that destroyed?

Witness: The grating was intact.

Re-examined by Mr. Bovill: I should say the grating was from 10 or 12 to 14 inches from the opening in the pipe and the surface of the pavement. I went a fortnight afterwards, and examined the Central's main; the grating would be about a foot above the level of the main, and in point of horizontal distance, about 12 inches from the main, measuring laterally. The hole in the main would be about 12 inches below it; the top of the main about 10 inches below.

By the Judge: It was an iron grating to allow of light entering the basement story, and the instertices were about ¾ of an inch.

Mr. Bovill: Supposing the grating there, would it ever have occurred to your mind as a gas engineer, that there was the slightest danger from the grating?

Witness: No.

Lord Chief Justice Cockburn: Not if you had seen an open window immediately below it?

Witness: It would not have occurred to my mind. I became wise afterwards, but it would not then have occurred to my mind.

Mr. Bovill: As a man of science and skill, did it occur to you that the gas would have ascended, and then descended?

Mr. Karslake objected to the question, which he said was not leading but driving.

Mr. Bovill: I shall come to it by a roundabout plan. [To witness.] What is the tendency of gas generally?

Witness: It rises in the atmosphere.

Lord Chief Justice Cockburn: That is, it diffuses itself.

Mr. Bovill: In order for the gas to get to the grating, it must have necessarily ascended from the trench?

Witness: It must ascend first.

Mr. Bovill: Would it ever have occurred to you that, after having ascended, it would descend?

Witness: It would not.

Mr. Bovill: Would there be any possibility of it getting into that grating without first ascending, and then descending?

Witness: There would not.

Mr. Bovill: We have heard that the man who was at work put his hand over the hole—would that have the effect of dispersing the gas?

Lord Chief Justice Cockburn: Before you pass over the point, let me ask—Supposing the gas entered the grating considerably mixed with atmospheric air colder than the air in the building, would it acquire a tendency to fall?

Witness: It would become heavier by the admixture of atmospheric air.

Lord Chief Justice Cockburn: Supposing the gas to be of the same temperature as the atmospheric air, would it not have the tendency to fall?

Witness: Supposing there were a great draft from the interior of the building, it would mix and go in.

Mr. Bovill: Take the case of gas coming out and mixing with the air—does it become more dense, or is it still lighter than the ordinary air, and has a tendency to descend?

Witness: It is lighter than the ordinary air, and would have a tendency to ascend, and would ascend.

Mr. Bovill: We have heard that the man at work had his hand over the hole—would not that have a tendency to disperse it?

Witness: It would.

Mr. Bovill: Take the other man, who was standing up above the opening—supposing he smelt as he was standing upright a very strong smell of gas, would that, or would it not, indicate to you that the gas was ascending from the hole?

Witness: Yes.

Lord Chief Justice Cockburn: It cannot escape from a hole of that sort without diffusing itself in a variety of directions; it is not, because a certain portion got through that grating, that we are to suppose that all of it got through.

Witness: No; a great portion of it would be mixed with the atmospheric air immediately.

Mr. Bovill: I believe the attention of scientific men has been much drawn to this matter since the accident, and various things have been suggested as to how it was possible it might have occurred.

Witness: Yes.

Mr. Bovill: Has it occurred to your mind that possibly it occurred by some mode never before conceived?

Witness: Yes.

Mr. Bovill: Is it possible that by some extraordinary current from the staircase, or by some other mode, it might have been drawn down?

Witness: It is just possible, but it would not have suggested itself to me in giving directions to those men.

Lord Chief Justice Cockburn: How has it suggested itself to your mind—as a bare possibility, or as a thing very likely to arise?

Witness: As a possibility—just possible.

Lord Chief Justice Cockburn: I will take the substance of your answer in this way—it appears to me possible, but not probable, that the gas may have got in by the grating.

Mr. Bovill: There was one point I omitted to ask. You are acquainted with the practice of gas companies—is it usual to send an inspector with the men when they go to lay on a service?

Lord Chief Justice Cockburn: I am glad you ask the question as I was going to do it myself. [To witness.] You usually leave it to the layers; you trust to them and do not send an inspector?

Witness: We send skilful men, and do not send an inspector to stand over them. The duty of an inspector is to attend to the complaints made by consumers; and where applications are made for new lights, he ascertains the number of burners required and then instructs the service layers what sized service they should lay, and he generally inspects the premises when the work is done. The inspector does not go to see the work actually done—that is not the practice; it is not done under his immediate eye.

Lord Chief Justice Cockburn: I understand that to involve this: You do not, before the men begin to work, send an inspector to see if anything is required, but employ skilful men to do the work.

Witness: Precisely. Those men have as much skill in the matter as an inspector.

Lord Chief Justice Cockburn: Now, I want to ask you this question—"Supposing that, upon the meter being turned on, which we understand took place at eight o'clock in the morning, an escape of gas had taken place from one of the burners previously fixed in the house, and that that escape of gas had been going on for a couple of hours or more, would you not expect to find that a considerable smell of gas would have diffused itself in that part of the premises where the gas was escaping?"

Witness: Where gas was escaping, it would.

Lord Chief Justice Cockburn: Now, we hear that these burners, with the exception of one, were on the ground-floor, or the basement, and the men of the Central Company said that they were in the basement five minutes before they began to cut the main. If gas had been escaping for two hours before that, must they not have been conscious that there was something wrong?

Witness: Not necessarily. The gas escaping would be mixed with the atmosphere of the basement, and, taking the higher level of the basement, would be perceptible against the ceiling; but the man going down below that strata would not necessarily have smelt it.

Lord Chief Justice Cockburn: But, supposing him to be at work at the hole by which the service-pipe got into the basement, and consequently with his face and mouth closed against the hole into which he was forcing his arm; and this within a few minutes before connecting the main, if there had been an escape of gas for two hours previously would he not have smelt it?

Witness: If the escape of gas was in the middle part of the basement, he would not have smelt the gas in the front, supposing there had been partitions or bales of goods between him and the hole which he was clearing out.

Lord Chief Justice Cockburn: I dare say it must have occurred to you to have been in a room in which an escape of gas from the burner has taken place, which was considerably higher than you, and that you have found it out immediately. Do you mean to say that at the level of the basement story you could have an escape of gas from a burner for two hours, and yet if a person went into it and remained in it for several minutes he could not smell the gas?

Witness: It would depend very much upon the quantity of gas escaping from the burner and the size of the room. If I were sitting on the floor of a room, all that quantity might have escaped without my smelling it. It would depend entirely upon the elevation of the room and the quantity escaping from the burner.

Mr. Bovill: Will your lordship ask him, if there were a current up a staircase, that would not have prevented the escape being detected?

Lord Chief Justice COCKBURN: But then they would have smelt it above.

Mr. BOVILL: Perhaps they did.

Lord Chief Justice COCKBURN: We have no evidence of it.

Mr. BOVILL: One of the witnesses said he did.

Lord Chief Justice COCKBURN: That was just before the explosion.

A JURYMAN: Would not the witness's nose be less sensitive in consequence of the gas he was smelling in the street from the earth than one of ourselves?

Lord Chief Justice COCKBURN: That is on the assumption that the gas was escaping from the earth.

The JURYMAN: There is always a trivial smell, and possibly his nose was less sensitive.

Lord Chief Justice COCKBURN: But that would not apply to persons down stairs. The plan being handed to witness, he stated, in reply to Mr. Bovill, that the distance from the hole in the main to the grating was eighteen inches.

Mr. *Thomas D. Tully*, examined by Mr. LUSH.

I am out-door superintendent of the London Gas-Works. Before that, I was surveyor to the Chartered Gas Company for six years, and with the Commercial Company eight years before that. I am acquainted with most of the mains about London. There are very many of them running under the pavement near the houses; it is considered preferable to lay them under the footpaths. In some cases, they are within a foot of the house. They must necessarily be so in passage ways where we have two or three companies mains passing through. During the twenty years experience I have had, I have been conversant with the mode of laying on service-pipes. I have laid about 3000 within the last few years. I heard the account given yesterday by the men of the way in which this work was done. That is, the way in which such work has been done during the whole of my experience. Taking into account all the circumstances which have been stated, it would not have occurred to my mind that there was the slightest danger in what they did. I have had frequently the same thing done under my own superintendence. I have known some mains built in the cellars of the houses themselves. It is not usual to put in a T-piece when connecting a service-pipe. I never knew it done in my life, unless we were supplying a service which was too large for the main. It would not have occurred to me, in laying a 1½-inch pipe into a 3-inch main, to put in a T-piece. We have never done it. It is not unusual to insert such a service in a main of that size. That size service is always permitted; beyond that, it would be necessary to put in a branch. I heard the mode in which the men stopped up the hole in the wall; that was the proper mode. The stuff they carry about with them is not altogether taken for that purpose; but the men would use the best material they have. It will answer very well, and resist the access of gas. It is not usual to send an inspector to see the service laid.

Cross-examined by Mr. KARSLAKE: It is prudent to stop up the hole to prevent the gas getting into the basement which might have ignited from the lights burning there; it would be necessary to take every precaution.

Lord Chief Justice COCKBURN: I suppose we may take this as undoubted, that if the gas were permitted to get into the basement in any quantity where burners are alight, the physical probability is the gas would explode.

Witness: In addition to that, gas getting into a house is a nuisance.

Lord Chief Justice COCKBURN: But we are looking to the probability of danger. You say that if it were foreseen there would be danger, it would be right to try to prevent it.

Witness: Yes; because there are always fires in a house as well as burners.

Cross-examination continued: I should not have thought it necessary if there were other apertures in the neighbourhood to have stopped them up, if by apertures you refer to the grating. I should not have stopped the interstices of the grating. If I had found an open window on the same level with the portion of the main which was being cut, I should have had it closed before I commenced operations; but not if it were a foot above the main.

Lord Chief Justice COCKBURN: You say that, if there had been a window in the wall a foot above the level of the main, you would not have thought it necessary to have it closed?

Witness: That is not my meaning. I mean to say, if there had been a window below the grating, I should not have closed the interstices. I should have thought the one side of the wall and the three sides of the earth would have formed a barrier to prevent this necessity. The gas, to have got in at this window, would first have had to ascend, and then descend through the grating.

By Mr. KARSLAKE: If I had found a window a foot above the main, I should certainly have thought it a prudent measure to have stopped it. If I had been on the spot in this case, and seen the windows, I should have closed them, even if there had been no light to cause danger, in order to prevent the inhabitants from being annoyed.

Lord Chief Justice COCKBURN: The learned counsel asks you, if you had been on the spot, and seen the window open, and knew that in the place there were lights burning, should you have thought it a proper precaution to close the window?

Witness: I should.

By Mr. KARSLAKE: I think the air inside the basement was, in all probability, warmer than that outside. It is a question whether there would have been a considerable draught through this open window into the basement story. I saw the premises after the fire. If there was a staircase at the other end of the basement, and the air in the department was warmer than outside, it is probable the air would have drawn in with considerable rapidity through those open windows.

Re-examined by Mr. BOVILL: Before this explosion happened, it would not have occurred to my mind that there was any danger arising from the proximity of the grating. It would not have deterred me from laying on the service-pipe, knowing that the window was open. If there had been an opening there without any window, I should have laid the service on with the gas burning.

Lord Chief Justice COCKBURN: Do you give your service-layers instructions to get the lights put out?

Witness: They have general instructions to that effect. I may tell your lordship that where there is competition, it is a difficult matter. In some cases, we should say that the lights must be put out, but there is a difference in districts where there is competition. Sometimes servants have a leaning to the other company and place difficulties in the way; and the men might not know the master or he might be from home. If the master ordered the gas to be laid on, the men would endeavour to meet the views of the company.

Lord Chief Justice COCKBURN: Supposing any difficulty thrown in the way by the servants, would you think it a proper thing to endeavour to see the master and have the lights put out?

Witness: There might be too much delay. The inspector might do it, but it is likely the workmen would not.

Mr. *Thomas Hersey*, examined by Mr. KEENE.

I have been chief inspector and superintendent of service-laying to the Imperial Gas Company for 7 years, and was in their employment in another capacity for 9 years before that. We have probably 500 or 600 miles of mains, and service-pipes along all that distance, running into the houses. I have heard what the material used by the workmen on this occasion was; it is the usual thing which is used. With a 3-inch main and a 1½-inch service-pipe, it is not usual to use a cast-iron T-piece. Having stopped up the hole, it would not have occurred to me that any extraordinary precautions were necessary in this case; it would not have struck me that there was any danger.

Cross-examined by Mr. HAWKINS: If I had seen the open windows, probably I should have had them closed. I certainly should not have closed the grating. It would not have been desirable to have lights burning in the basement. I do not know it would have occurred to my mind that there being an open staircase at the other end would have created additional danger. I do not think it made any difference.

Re-examined by Mr. BOVILL: In laying on gas, there may be an annoyance from the smell without danger, and we generally take precautions to prevent the least annoyance. Before this accident occurred, it would not have struck me that there was any danger with an open window eighteen inches off.

Lord Chief Justice COCKBURN: The difficulty with me is to understand what distinction you make between a hole in the wall and the window? If it were necessary to stop up the hole, why not the window?

Witness: The hole in the wall was directly at the end of the open channel from the main, but the grating was not so close to it.

Lord Chief Justice COCKBURN: Is it not a law as to gaseous fluids, that they disperse themselves?

Witness: We may expect the wind to take a small quantity of the gas escaping into the street, and it is a very common thing to lay on gas to houses with the doors and windows open.

Lord Chief Justice COCKBURN: Would you do it with lights in the premises?

Witness: Yes; there is always a kitchen fire. We leave it, generally, to the workmen as to having the lights put out. We instruct them to avoid lights as much as they can. I do not think I have given instructions that the lights should be put out.

Mr. *R. P. Spice*, examined by Mr. BOVILL.

I am an engineer. I have had a great deal of experience in gas for nearly twenty years. I heard the description given by Bicknell and Allen of the course which they adopted. In my judgment and experience, that was quite the proper course. I have heard that at the distance of 18 inches there was a grating, which communicated with the area, in which there was an open window, and lights burning in the basement. Knowing that, it would not have occurred to me to do anything more than these men did.

Lord Chief Justice COCKBURN: So the course adopted was a proper one with reference to the circumstances—including in those circumstances the fact of the grating, the open window, and the lights.

Witness: Quite so, my lord.

Mr. BOVILL: With all your experience and knowledge, would it have occurred to you that there was the slightest danger from that area and those lights?

Witness: No.

Cross-examined by Mr. HAWKINS: I should have thought it desirable that the lights were put out to avoid danger of explosion from the gas in the main.

Re-examined by Mr. BOVILL: If the hole were stopped, there would have been no danger at all: that made the difference.

Lord Chief Justice COCKBURN: If you had stopped the hole, would you not have asked to have the lights out also?

Witness: Not at all. I should have depended upon the diffusion of the gas in the street.

Mr. BOVILL: My lord, I really hardly care about occupying your attention by calling any more engineers.

Lord Chief Justice COCKBURN: You must take your own course, Mr. Bovill, about that.

Mr. BOVILL then proceeded to sum up the evidence for the defence. He said he had called some of the first engineers in London upon whose experience it had been proved that the course adopted by his clients was the usual course adopted everywhere in reference to laying down service-pipes, and that it was the universal course adopted in London. On the other hand, the plaintiffs had not produced one gentleman of knowledge and skill to support their allegation of negligence, except the engineer of a rival gas company, and whose opinion as to the use of bladders and a T-piece appeared to have been formed after the event. It would be remembered that the whole ground upon which the learned counsel for the plaintiffs attributed negligence in his opening address was that the servants of the defendants had not bladdered the main in question. The plaintiffs had the whole of England open to them, and yet they could not, knowing fully the case which they had to support, for this matter had undergone a preliminary inquiry before the coroner, find a single engineer who would have the boldness to come forward and say that he should have adopted the course which Mr. Upward said ought to have been pursued in this instance. After recalling the attention of the jury to facts proved by the defendants, and pointing out how they bore upon the evidence in support of the plaintiff's case, the learned counsel concluded by observing that the first question to be decided was, whether, on the plaintiff's showing, it was the gas from the defendants main which caused the explosion; and if they were satisfied that it was, then they had to determine upon the testimony of the defendants witnesses, whether or not all due, reasonable, and proper precautions had not been taken by them to prevent the mischief which subsequently occurred. If this was made out to their satisfaction, then he apprehended that, under his lordship's directions, the defendants were entitled to their verdict.

Mr. *Upward*, recalled.

Lord Chief Justice COCKBURN: Mr. Upward in reading over your evidence, I see you say this "when I got to the premises, the men had already made the hole; they were using both the hammer and the tap. A new service-pipe was intended to go immediately over where ours had been, so that it could enter without ours being taken away. I saw that the brick-work was fresh cut." You remember saying that distinctly?

Witness: I do my lord.

Lord Chief Justice COCKBURN: Now at the time you saw the brick-work fresh cut, the men were outside working at the main.

Witness: They were.

Lord Chief Justice COCKBURN: Was your attention at all closely called to the brick-work where it was fresh cut?

Witness: Not more than seeing what progress the men had made, that I might report it to Mr. Morley. [In answer to further questions—witness said]: The hole was somewhere about the size stated, 14 inches by 8. It appeared to have been enlarged so as to admit of another service being put

in. I certainly did not see that it was stopped up with yarn. I did not stoop down to see, and I will not take upon myself to say it was not.

Mr. BOVILL: He said in his examination that he did not see a light through the hole.

Witness: I did not stoop down, and therefore I did not see a light or yarn.

Mr. HAWKINS, in a speech of some length, replied upon the whole case. Referring to an observation made by Mr. Bovill, he said the question of whether the insurance company were to be indemnified was entirely beside the question which the jury had to decide, and the Central Gas Company had no right to protect themselves against the consequences of their own negligence by saying that the plaintiffs were insured. The simple question for the jury was, whether the fire at Mr. Morley's premises was caused by a want of due and proper caution on the part of those who were intrusted with the laying of the service-pipe there? The only reason why he had alluded to the insurance office in his opening address was, that he thought it was a matter which it might become material should be brought to the attention of the jury in the event of its being their province to assess the damages between the parties, in which case it would be necessary to show how far Messrs. Blenkiron were pecuniarily interested. The point for the decision of the jury was, whether there was a want of proper care by the defendants, and not as his friend, Mr. Bovill, had put it, whether the company had done what other men had done hundreds of times before? That was no part of the issue. In the case of a colliery explosion arising from the negligence of the miners in removing the cover of their Davy lamps, it would be no excuse to say that it had been done hundreds or thousands of times before without accident; nor would it be accepted as an excuse, in the case of mischief with a brewer's dray, that the men employed should be able to show that hundreds of other men had ridden when drunk upon the shafts and met with no accident, but the horses had found their way home in safety. The point to be considered here was, whether, having reference to the state of circumstances as they existed, and to the knowledge of those who had the work to perform, the defendants men had exercised due and proper precaution, as sensible men dealing with a dangerous fluid, so as to prevent its escaping and reaching a spot where danger must of necessity arise. The learned counsel for the defendants had put it first of all, that the explosion was caused, not by the gas which escaped from the main of the Central Company, but from gas escaping from a burner in the building supplied by the Chartered Company. He (Mr. Hawkins) was at a loss to find the smallest tittle of evidence to warrant such an assertion. The evidence of Mr. Jeffrey distinctly proved that the whole of the burners were safely turned off on the Saturday night, and was there any pretence for doubting his accuracy? But supposing Mr. Jeffrey had committed the irregularity insinuated, it was clear that the supply at the meter was not turned on again until between eight and nine o'clock on the Monday morning, and the interval between that period and the time of the explosion was not sufficient to allow of such an accumulation of gas, admitting that it escaped all that while from a burner not turned off, to account for the consequences which followed. But, beside this, it was proved on the testimony of several witnesses that no smell of gas was experienced on the premises till shortly before the explosion, whereas, if it had been escaping even in the small quantity which would escape from an unturned burner during the whole morning previously, it would have caused great inconvenience and annoyance to the persons engaged in the premises. He thought the jury would be of opinion from all they had heard that there was no escape of gas into the basement until the defendants main was tapped, and that it was by neglect on the part of their servants that it was allowed to get there, and so cause the disaster for the damages arising out of which this action was brought. If, as he believed, it was proved to be the Central Company's gas which was the cause of the mischief, it then became incumbent upon that company to show not only that they had used ordinary precaution, but due and proper precaution to prevent accident.

Lord Chief Justice COCKBURN: That is very true; at the same time it is an element in the question whether a man has done that which persons ordinarily do under the same circumstances; because it is fair to presume that what is usually done as the result of the general experience of persons in that particular department, who know the dangers they have to meet, and the ends they have to achieve, is the right one. It does not follow that, because persons are habitually careless, when disasters arise they should not be visited by the consequences; but when we find that all persons conversant with the business are uniform in pursuing the same course, it is fair to presume it is a right and proper one.

Mr. HAWKINS said he was desirous of inviting the jury to consider that it was not in itself sufficient to afford an answer to an action, that what had been done was the ordinary course of proceeding; if that ordinary course of proceeding should be found by them to be not consistent with due and proper precaution. It must be shown that what was done was proper to be done with reference to the particular circumstances of the case with which the parties were dealing at the time. The learned counsel then went over the evidence at considerable length, and concluded by expressing his conviction that the jury would be of opinion the defendants had not used that proper care and caution which they should have done when dealing with an inflammable and dangerous fluid such as this, and the plaintiff was entitled to their verdict, with such damages as they should think fit.

John Locke recalled.

Lord Chief Justice COCKBURN: You have told us that one of the burners was not lighted on the Monday morning. How came that?

Witness: We only lighted that when we were at work at the hydraulic press.

Lord Chief Justice COCKBURN: That was a burner used for the purpose of giving light to the hydraulic press?

Witness: Yes.

Lord Chief Justice COCKBURN: When had you last used it?

Witness: On the Saturday preceding, about one or half-past one. I afterwards turned the burner off myself.

Lord Chief Justice COCKBURN then proceeded to sum up. He said: Gentlemen of the jury,—This is a case deserving of your very serious and deliberate attention, not only on account of its great importance to the parties concerned, but also on account of the inherent difficulty which almost always exists in cases of this kind, where you have to determine how far circumstances under which an act has been done, or anything omitted to be done, can fairly be considered as establishing a charge of negligence, upon which a party is to be made responsible for damage which has accrued. The present case certainly involves considerations of great difficulty and nicety, and is deserving, as I have said, of your very careful attention. Now, two main questions have been raised by the learned counsel who have addressed you on behalf of the particular parties in this case. The first is, whether the gas which exploded and caused the mischief in the present instance, proceeded from the defendants main or not? and, secondly, whether in anything which the servants of the company did, or omitted to do, there was such negligence on their part as to make them responsible for the damage which has resulted. It must be obvious to you at once that the first question lies at the root of the whole inquiry, because, even though there may have been negligence on the part of the defendants servants, unless it was the defendants gas exploded, that negligence, even if it existed, could have no effect whatever in causing the injury sustained. It becomes, therefore, a very important question in this case, to ascertain whether the explosion was an explosion of gas which entered the premises from the defendants main? or whether it was an explosion of gas arriving there from any other source? The case submitted to you on this first question, on the part of the plaintiffs, may be stated to you in a few words. Here are premises which, being opened on the Monday morning, continue in perfect safety till an explosion takes place. The gas is turned on as usual; the burners are lighted in the ordinary course; nothing takes place to indicate any irregularity in the supply of gas; there is no smell manifested—no inconvenience felt; the gas burned in its regular way until, at a certain time—the defendants men having visited the premises early in the morning, arriving somewhere before ten o'clock, and having proceeded to make a hole in the wall, for the purpose of admitting the new service-pipe which they came to lay down, dig their trench, and proceed to open the main. They are occupied in opening that main during some period ranging from ten minutes to twenty minutes, whichever it may be; and no sooner do they begin their operations than, as the plaintiffs allege, a smell of gas is immediately perceived—faint at first, becoming more strong as time advances, and at length becoming overwhelming, and then an explosion takes place which shatters the premises, causes a fire, and, by means of it, the plaintiffs property is destroyed. That was the simple case submitted to you on behalf of the plaintiffs. The defendants say: "It was a mistake to suppose that, because an explosion of gas took place, and a fire ensued immediately, or almost immediately in the order of time after our men began their operations, that you are to connect the phenomena which you are seeking to solve with the operations of our servants as cause and effect. In the first place, it was physically impossible, because the only communication between the main we opened and the premises in which the explosion took place was by means of a hole in the wall, which hole our men carefully stopped. But beside that we submit a plain and intelligible theory of how this explosion happened," and then they proceed to say that there being burners supplied through a meter on Mr. Morley's premises, one or other of those burners must have been left with the gas not properly turned off on the Saturday night, and that though there was no escape of gas until the supply at the meter was again turned on, as soon as this latter event occurred the gas would begin to escape, and that by degrees in the course of a couple of hours or more, it would accumulate in such a quantity that, coming into contact with the burners alight in the basement, it would explode; and so the mischief was caused. Because no doubt the defendants must have felt this, that seeing there was an explosion of gas following immediately upon the operations upon the main pipe, done by the defendants servants, that the sequence and order of things would so naturally connect them as cause and effect in the minds of persons to whose attention the circumstance was brought that it is necessary, in order to get rid of the effect, which otherwise would be produced in the minds of persons hearing the story, to suggest some opposite theory to afford a solution of a thing which must be explained in some manner or other. And therefore they submit this hypothetical case—the burner left with the gas improperly turned off, and an escape from that burner taking place on the morning of the explosion. Now the first observation which arises upon that, and which is made by the plaintiff's counsel, is that it is altogether hypothetical, and rests upon no ascertained fact. If we had the fact as a datum to start with, that one of the burners had been left in the condition hypothetically suggested by the counsel for the defendants, it would help us a long way towards the conclusion to which the defendants counsel seeks to draw your minds. But it is put before you simply as a surmise—as a speculative probability, and no more. The man whose business it was to turn off the gas on the Saturday night is called before you, and he swears positively that he turned off the gas from the burners as well as from the meter that night. Something has been said about the order in which he dealt with the meter and the taps, and it is said that, instead of turning off the gas at the meter before the last burner, he ought to have reversed the order. I do not know how that is; none of the gas authorities called before you have been asked the question, and we can only judge for ourselves; but I own I do not see how his turning off the gas at the meter before the last burner on the ground-floor can have much to do with the matter, if he turned the whole off which he swears he did. But it is said there was plainly some irregularity on Monday morning, because there were four burners on the basement story, and three only were lighted; how comes that? No question was asked on that somewhat important point of the witness Locke, who lighted the gas on the Monday morning. I therefore thought it right to recall him, because I was anxious to throw light upon the subject. I called the man, and he gave an explanation, and it is for you to say whether it was not perfectly satisfactory. He says, "On that morning I lighted three, and the reason I did not light the fourth was, because it was never done except we were using the hydraulic press, when we have recourse to that instrument, which we had not on the Monday morning." "When did you last?" I asked. "On the Saturday before we used the press, and we discontinued using it at one o'clock, when I turned off the gas myself." Therefore, that is accounted for. There were three burners lighted on the Monday morning, and as they were lighted and burning, it follows there could be no escape of gas from them, and there could be no escape from the fourth, if he is right in saying he turned it off, which he swears he did, on the Saturday afternoon. It is then said that there may have been, and the probability is that there was, an escape of gas from the burner on the ground-floor, which was the one turned off the last thing on Saturday night. To meet that hypothesis, there is the remarkable fact, if that burner had been the cause of the escape, the gas must have been smelt on the ground floor, and all agree that no gas was smelt there. Mr. Upward, the superintendent of the Chartered Company, went into that part to inquire whether Mr. Morley was upstairs a few minutes only before the explosion, and there was no smell upon the ground-floor when he spoke to the clerk there. If there had been this constant escape of gas, we may suppose the clerks on the ground-floor would have been inconvenienced by it, and something would have been done to ascertain its cause. But there was nothing of the sort, and therefore it is for you to say whether you think you have in this hypothesis anything more than a mere speculative surmise, whether you think there is any foundation for it in fact, any evidence before you upon which you can safely come to such a conclusion? Added to this, there are one or two pieces of evidence which it occurs to me as very material in solving this first and very important question. One is this: we have it as an ascertained fact that, from a single burner of the average ordinary size, there would not be a greater consumption of gas, and therefore a greater escape of gas than, at the outside, 5 cubic

feet per hour. These burners were supplied with gas that morning at somewhere about half-past eight o'clock, when Locke tells us he turned on the gas at the meter, which would regulate the supply to all the rest. The explosion took place somewhere between half-past ten and a quarter to eleven; therefore, there was not more than two hours, or two hours and a quarter, during which the escape of gas took place; so that, supposing there was an escape of 5 cubic feet per hour, it would not give a greater quantity than 10 or 12 cubic feet as having escaped during that period. We find, from the evidence of one witness, that it is when the proportion of gas is 1/9th to 8 9ths of atmospheric air that the explosive capacity and tendency of the mixed elements is the greatest. The basement story of these premises was a room of some size, and must hold a very large amount of cubic feet of air. Which is more probable, that 10 or 12 cubic feet of gas mixing with the atmospheric air produced the proportion in which the explosion took place, or the larger quantity, which we are told would have escaped from the hole opened into the main? This is not an unimportant consideration to look at in determining the question. But, besides this, we have another, as it strikes me, not at all unimportant element. If the gas which caused the explosion had proceeded from the gradual and progressive escape of gas from a single burner going on during two, or two hours and a half, you would have had a gradual increase of the presence of gas, as perceptible by the senses. The smell and inconvenience arising from it (the organ of smell and taste, we know, it affects most powerfully, and that it is distressing to breathe in an atmosphere of gas), we should expect would have gradually increased up to the last moment. Is there any evidence upon the subject? It appears, on the evidence of the defendants people, that they were in the basement ten minutes or five minutes before they began operations outside, which brings us down to a period very proximate to the time of the explosion, and they sustained no inconvenience, and were not conscious of any gas escaping. Is it possible that there could have been a sufficient quantity of gas to explode, and, in exploding, to blow up those premises, and cause all this destructive mischief, without men who are familiar with the subject, and who were in those premises twenty minutes before the explosion, being conscious of the presence of gas? One gentleman, it is true, told us the place might be comparatively full of gas; but, being somewhat higher than the part of the room which these men were in, they might not smell it. I have no doubt that gentleman means to tell us what is true and honest; but I must say, one's experience of gas escaping in the same room in which one is sitting is not altogether in harmony with that gentleman's scientific view of the subject; and it is for you to say whether all the scientific evidence in the world would satisfy you of a fact apparently so outrageous and improbable, that after this gas had been escaping for two hours and a half, these men could go into that place a short time before the explosion happened, and not be conscious of it. And it is not only that, but we have the evidence of one or two gentlemen who were at the house in question almost immediately before the explosion. The evidence of Mr. Fretwell is, as it strikes me, very material. He says he went in to speak to Mr. Morley; that he went up to the first floor and came down again; and, when he came down, he was struck with the offensive accumulation of gas in the lower part of the building; that he addressed the men whom he saw working at the main, and whose operations he naturally enough associated with the inconvenience he and others sustained, and told them they were poisoning the inmates of the house. And he adds this important fact, that the gas which he had smelt slightly only on entering the premises, though he was not there more than two or three minutes—just time enough to hold a communication with Mr. Morley—became so offensive when he came down that he addressed himself in strong and energetic language to the men at work. Why do I say that is important? Because the question you have to determine upon this part of the case turns a great deal upon this—whether this was a gradual accumulation of gas, or gas suddenly finding its way into these premises with a sort of irruption, rushing suddenly in; because the one view of the case would be consistent with the hypothesis of the plaintiffs—the other only with that of the defendants counsel. If the defendants view is right, that this was gas proceeding from the Chartered Company's pipes already in the building, gradually escaping from the burner, the inconvenience would be gradually felt—the evil would manifest itself by successive stages. This evidence, if you believe it, tends to show that, so far from that being the case, the inconvenience from the presence of the gas to the persons affected was sudden, and instead of gradually making itself sensible, was overpowering in a very short space of time. Between these views, and upon this evidence, you have to choose one or other of these alternatives. Was this the gas of the Chartered Company escaping from one of their branch pipes? or was it, as has been suggested on the part of the plaintiffs, gas escaping from the main of the defendants when it was opened? You have the fact—the undeniable fact—of the proximity of the defendants main to the premises. It is plain there was a channel of communication through the trench which had been dug, along which the gas, through the pressure which came from behind, might have been propelled: and even if you should be of opinion that the defendants have established the fact that the hole in the wall, enlarged by the defendants men, had been effectually stopped up, so as to prevent the ingress of this subtle gaseous fluid into the premises, yet there is the fact of an open grating and an open window through which it could have entered. With these facts on the one hand, with only the possibility of the burner having been left without the gas being properly turned off—though denied positively upon the evidence of the persons whose business it was to turn it off—how can you come to any other conclusion safely than that it was gas escaping from the defendants main, which found its way into the plaintiffs premises, and caused the explosion. That still leaves behind the question—and far greater difficulty—whether, though this was the gas of the defendants, the defendants can be fairly charged with negligence so as to be made responsible for the damage occasioned. I need not tell gentlemen familiar as you are with the world that a company who send their servants to do an act for them are responsible for the negligence of those servants, if damage results from such negligence. Therefore, the question you really have to determine is, whether there was negligence on the part of the defendants men, who were employed to lay down this service; if so, the defendants are responsible. And the negligence may be in either of these two alternative forms, either omitting to do something which in the exercise of reasonable care, and caution, and skill, they ought, in your judgment, to have exercised; or in the doing an act dangerous in itself, under circumstances in which it was not consistent with prudence, and care, and reasonable caution that that act should be done. Now the case presented on the part of the plaintiffs, whereby it is sought to make out the negligence of the defendants, has assumed in the course of the inquiry one or two different forms, and you will have to consider it in each of these aspects, and all its bearings. At first, I am bound to say that the main ground of complaint against the defendants made by the learned counsel who opened the case on behalf of the plaintiffs was this—that, opening their main, which running under the pavement was so close to Mr. Morley's premises, they had not resorted to a well-known expedient in the supply of gas, viz., that of inserting—not merely making the hole in the main, and then inserting the service-pipe—but inserting what is called a T-piece, in using which they might have resorted to a further well-known expedient, viz., that of bladdering the main pipe, and so preventing the gas, from either the one or the other end of the pipe, forcing its way out, and so causing mischief. That which was certainly stated, and very prominently set before you at the outset of the case, seems very materially to have been abandoned. Not much was said about it by Mr. Hawkins in reply; and I think the only witness who has at all attempted to maintain the necessity of resorting to such an expedient was a gentleman who is the superintendent and officer of the rival company—the Chartered Gas Company. I suppose there cannot be much doubt that this company does not look with any degree of favour upon the present defendants; and, without at all meaning for a single moment to suggest or think that that gentleman would come here to state anything he did not believe, I cannot help thinking, as there is a tendency in most men to be very wise after the event, there has been developed a tendency in this gentleman, who is naturally disposed to it by his position, to take as adverse and unfavourable a view of the case as can can be taken. None of the other witnesses support him in that view. What seems to be the case is this:—That this expedient thing, well-known and resorted to in the supply of gas, is only resorted to where it is proposed to make a hole in a main, which hole is unduly large in proportion to the size of the main itself. Then, as it would be highly inexpedient to cut to the extent of 2 or 2½ inches in a 3-inch main, they resort to the method of taking a piece of the main out altogether and putting in a new branch, which enables them, for it goes with the service-pipe, to put it in without the danger of weakening the main itself. But then that is not resorted to where all that is required is to put in a service-pipe which does not bear an undue proportion to the size of the main itself; and those gentlemen who are conversant with this department of the business, tell us that a 1½-inch service-pipe is not at all too large for the size of a 3-inch main. Therefore, I think, that part of the case was wisely passed over by the learned counsel who addressed you in reply on the part of the plaintiff. That was one of the points made, and it is for you to consider, ought they in the exercise of common ordinary prudence to have resorted to the expedient of using a T-piece instead of cutting the hole in the manner they did? But that is not the main objection that is now urged to the proceedings of the servants of the defendants. It is said that the whole thing was done with a careless disregard to the safety of the surrounding premises. In the first place, it is said you ought to have taken care that there were no means by which the gas you were just about suffering to escape, and escape in large quantities, could get into those premises where lights were burning. You ought effectually to have stopped up every aperture by which the transit of the gas could be effected, or have adopted the only alternative remaining—viz., to insist upon the lights being put out before you suffered the gas to escape. In the first place—I am now discussing the case with you upon the assumption that the gas which exploded was gas which got into those premises from this company's main—that being so, did the company's servants do what was necessary, that is to say, what was necessary with reference to ordinary and reasonable caution and care? We are all wise after the event, but it is not because from some unforeseen cause, which it would not occur to the most sensible, discreet, and prudent man to forsee that damage would arise, that those who have learnt by experience that in the one case out of a million such an accident occurred; and then see the mode by which it might be prevented—it is not because of such wisdom after the event, as the result of experience, that you are therefore justified in the conclusion that those out of whose act mischief has arisen were guilty of negligence, if they have done all that men in the then state of knowledge might reasonably be expected to do. Now, that this is an operation attended with some danger, cannot for a single moment be denied. This lamentable event abundantly proves it to be so; but, beside that, all the witnesses concur in saying that which one's own knowledge must bring to one's mind, that to allow a quantity of gas to escape into premises where there are lights by an ignition from which the gas may be caused to explode, is a thing which is necessarily attended with danger. Those who do acts and carry on operations which, however lawful in themselves are attended with danger, are bound to adopt all reasonable care, and all reasonable means which reason and experience suggest, for the prevention of such danger. It was rather largely—too largely I think—asserted on the part of the defendants, that with persons carrying on operations attended with more or less danger, if it was a lawful operation in itself and they did all that was usual, that would exonerate them. In considering, which it is your province to do, for it is not a question of law, but of fact, whether there was negligence on the part of the defendants or their servants in doing what they did, I think the observation from the learned counsel for the plaintiffs, is well worthy of attention. He says, it is not because what people do under ordinary circumstances was done in this case, if the course ordinarily pursued is manifestly an imprudent and careless one, therefore, they can ask for immunity, because other persons are as careless as themselves. In that observation I entirely concur, but I think in considering whether a person does that which, as a prudent man, it is incumbent upon him to do, it is always an important fact to start with, that other persons in similar circumstances, who may be taken to be acting under a proper sense of duty, do the same thing. Now, there can be no doubt it is of essential importance, that gas should be supplied to a metropolis like this. It is the cheapest form in which our science can supply us with light, and it becomes in a densely crowded city a necessity of life, and we cannot do without it. The only mode in which it can be administered to the wants of a large population is by pipes connecting themselves to the large mains, which are like veins, trunks and arteries by which this fluid is distributed over a large city or town. By having smaller pipes or services connected to these trunk-mains, the gas is conveyed to the premises in which the light is to be used. In order to connect them, the companies who supply gas for the purpose of lighting are under the necessity of inserting, from time to time, as convenient, or particular individuals require supply, fresh service-pipes into the mains. That is a lawful work, and a work required by the necessities of mankind; but it is admitted, I think on all hands, that it is attended with more or less danger, and the moment it is admitted that such an operation is attended with danger, it clearly becomes the duty of the individuals who undertake the operation to conduct it with reasonable care, prudence, caution, and skill. Not—I quite agree with the learned counsel for the defendants—not that they are to be insurers, or that they are to undertake to protect those to whom they give a supply of gas, or the premises in the neighbourhood, against every possible contingency and every form in which accident or disaster may manifest itself. What they under-

take to do, and what they are bound to do is, to use and apply reasonable caution, care, and skill in the conduct of this operation; and it is for you to say, on this question, whether the defendants, or their servants acting on their behalf, have done according to the exigency of such a duty. If they left the hole open, so that the gas could get through the hole in the wall, you will not hesitate to come to the conclusion that there was negligence in the conduct of this operation. They say they stopped that hole up, and stopped it effectually; and the first question for you to determine is, are you satisfied on that point? You see, I am discussing the question on the assumption that it was the defendants gas which caused the explosion: and, if so, it must have got in somehow. The plaintiffs say, it got in through a hole in the wall, and it is not to be believed that the defendants servants stopped up the hole effectually. And you are reminded that these are men who come forward to defend themselves; for, though it is true their employers are sought at the present moment to be made responsible for the damage, yet the imputation of negligence is upon these men. It is for you to say, under these circumstances, whether you believe their statement, that they did stop up the hole. Assuming them to have done so, which would relieve them from any imputation of negligence for leaving that open, still it is said, that there was negligence—and gross negligence, too—in this respect, that although that hole was stopped up, those who stopped it up knew perfectly well that there was an open grating and an open window communicating with these premises; and, as gas is known to be a gaseous fluid which diffuses itself through the atmosphere in all directions, and as this was rushing out with considerable force and impetuosity, impelled by the pressure behind, the natural impulse at first would be, to take it in that direction, it must have been obvious to them, if they allowed this gas thus to escape immediately in the proximity of an open window, the gas would naturally rush into that window, if it did not enter at the hole; and, if it did, that shows that there was negligence—say the plaintiffs—on the part of those who were allowing that gas to escape in not taking the proper, common, and prudential measure of caution in stopping that window. On the other hand, it is said there is a difficulty in conceiving it possible that the gas could have thus entered, because the trench along which the gas was first propelled was lower than the grating; and, in order to top the grating, it must first ascend; and then the window is a little lower than the grating, and it is difficult to conceive that gas would first ascend, and then descend and find its way through the window; therefore—say some of the scientific witnesses—it is improbable that the gas would take that course. Beside that, even if that were the course which it took, yet, nevertheless, it was a thing quite unlikely to occur to the mind of anybody employed to open a main and lay a service-pipe. When he knew he had stopped the orifice in the wall through which it could pass, it never would have occurred to him, because there was a grating and a window, the gas would ever find its way into the window. Here two questions present themselves. In the first place, was that the course the gas took? Do you believe the gas went into that window? and, if so, then comes the question which is entirely one for for you to solve—ought a man employed in that operation to consider all the surrounding circumstances; and, if he did, ought his mind to be alive to the danger of the gas passing through this open window? Which was it, a thing so likely to happen, or so out of the ordinary and usual course of events that though a man neglected and overlooked a matter which, in the sequence, was so overwhelming, he would not be open to the charge of negligence in the discharge of his duty? You will have both these questions to determine. Did the gas go in that way? and if so, was it a want of proper care and caution to allow the gas to escape when there was this open window through which it found its way into Mr. Morley's premises? But the plaintiffs say there is another and equally important circumstance upon which a charge of negligence against the defendants is fairly established, and that is, their proceeding with this work while there were lights burning in the basement below. I think this seems to be admitted that it is certainly a more prudent, and much wiser course, to insist upon the lights being put out before you let loose a dangerous element, whose course, when once it is mingled with the atmosphere and carried away, people can no longer control. We find the fact here, too, that the men themselves strongly urged that the lights should be extinguished, although, upon the workmen of Messrs. Morley saying they wanted them for their work, they appear to have desisted from any further urgency in the matter. I cannot help thinking that it is to be regretted the men did not inquire whether Mr. Morley was at home, and say to him, "Your men decline to put out the lights, but it is a course which we are always instructed to follow, if not impossible; pray give an order to this effect." If they had done that, possibly this calamity might have been avoided. But they did not. I thought it right to ask one of the gentlemen connected with these great gas companies what is the usual course on these occasions, with a view to see how far it is considered a known element of danger, where the gas is turned on and alight. "What course do you pursue?" I asked. The answer is, "Where we have got a district to ourselves, and no competition, we insist upon the lights being put out; but when there is competition, then we are very apt to take the course which the occupiers prefer; and as servants are very much in the habit, if they favour the other company, to throw obstacles in the way, if there is any difficulty made, and the master is in the way, we should ask him; but if not, and there would be any delay occasioned, we go to work, and do it in the best mode we can." In the present instance, Mr. Morley was at home, but he was not applied to. That evidence seems to be admitted—viz., that it is a more prudent course, and one the witnesses would prefer to adopt, if there was no difficulty thrown in their way, always to have all the lights extinguished in the immediate neighbourhood of the spot where a main has to be tapped, and gas in considerable quantities allowed to escape. They say, however, that they usually leave these things to the men, and it is for you to say whether, under the circumstances, it is negligence leaving these things to the men, and these men, in such a case, although they themselves, according to the instructions they have received, believe it would be more prudent and proper to have the lights put out, yet nevertheless, if not put out, go about their work just the same. If this company can say, "We have done nothing in the present instance but what the experience of all companies shows may be safely adopted"—that it is the ordinary course of proceeding which experience justifies and warrants—they have a strong ground for a verdict from you. But if, on the other hand, there is a course which reason and prudence would suggest, but which the convenience of a particular company, or their servants, induces them to abandon, I do not know how far, when a third person comes into the field, and complains that he has sustained injury, the convenience of the company or the convenience of the individual occupier will constitute and afford an answer for the injury sustained by what by possibility is the common negligence of both. You see this is not Mr. Morley's complaint. If it were Mr. Morley's action, the company might say, "You are a party to the damage; you allowed us to go to work in the way we did, and your servants would not have the gas put out." But here it is not Mr. Morley; it is a man who comes forward and says, "You, the company allowed a quantity of gas to escape and get into premises contiguous to mine under circumstances which were not consistent with due care and prudence that the presence of gas should be allowed,—you did it with an open window near, and what is more, you did it with burning lights within; and the result is, my premises were destroyed and my property damaged." He says, "You yourselves admit that where you can exercise your own discretion, unfettered by the control which competition puts upon you, you insist as a matter of caution and prudence, that the lights shall be put out before the gas is allowed to escape in large quantities; you, or your servants in the present instance, departed from that wiser course because you were desirous of consulting the favour of Mr. Morley or his servants; but, the very course you pursue, when you only consider what is proper to be done is a different one, and what is it to me that on the present occasion that, with a view to meet Mr. Morley's convenience, or your own, you have taken a course which, by yourselves, it is admitted under different circumstances, would be a prudent and proper one?" That, certainly, is seriously deserving of your consideration in this matter, and it is for you to say whether, looking to the fact that gas when it escapes in any quantity into any convenient place, and when it comes into contact with fire, is of a most dangerous character—when, in this case, you find that this conclusion is the one at which you arrive that the gas escaping from the company's main did get into these premises, and that it was allowed to escape from the company's main, when there was an open window into which it actually entered, when lights were burning in the premises, it is for you to say whether, under these circumstances, the servants of the company were negligent in either of these two particulars to which I have called your attention—whether in not closing all the apertures through which the gas could have entered, or not taking measures to insist upon the extinguishment of the lights; or on the other hand, in not saying "until the circumstances existing at the present time, and out of which danger may arise shall have been removed—not until then will we begin carrying on an operation which may, under existing circumstances, be attended with danger." Undoubtedly it is for those who seek to fix the company with this liability to make out a case of negligence against them, and unless that is made out entirely to your satisfaction, you will not find your verdict for the plaintiffs, whereby they will be sufferers to a considerable amount. But on the other hand, if you think the defendants servants omitted anything which proper care and prudence should have suggested, or if they undertook a dangerous operation under circumstances which rendered it additionally dangerous to the adjacent property—if you think that, your duty will be to find your verdict for the plaintiffs. It has been strongly urged upon you by the learned counsel for the defendants, that in this case it is the insurance company who are really the plaintiffs before you; that they, having received the premiums upon this insurance, ought to be content to pay the loss, without seeking to visit it upon the company by whose act, they say, or whose omission the injury has been sustained. Well, that is a taking argument, and one not altogether ill calculated to produce a considerable impression. You say, "Here is an insurance company; they have had their premiums, why not pay?" On the other hand, gentlemen, I am bound to tell you that you will be altogether departing from your duty, if you give effect to any such consideration. If a person by any negligence—any act done or left undone—causes mischief, upon him the consequence undoubtedly ought to fall; and although insurance companies undertake, in consideration of the premiums they receive, to bear harmless those who sustain loss by fire, it would be too much to expect that, in addition to those contingencies arising from accident and undiscoverable causes against which they undertake to protect individuals from loss—I say it would be too much to expect that they should submit to have added to these losses, for which they have to make compensation, losses which arise from negligence, and which can be clearly traced to the individuals who have been guilty of it. Nor is it for the public interest that it should be so, because the rates of premium will of course be always proportioned to the average amount of loss and gain, and if to the losses which cannot be ascribed to the negligence of individuals, or at all events brought home to individuals, were to be added the losses which can be traced to such negligence, those losses, though they would fall upon the office in the individual cases, in the end would fall upon the insuring public. But really with such considerations we have nothing to do. You must deal with the case upon the issues which arise upon it as if the plaintiff stood before you an uninsured loser by the fire. If he were uninsured, whatever your sympathy with him might be, it would be my duty to say you must not gratify it at the expense of the company, unless the evidence clearly brought home to them the negligence with which they are charged. So, on the other hand, though he happens to be insured, I am bound to tell you that though you may sympathize with the company in being called upon to make good this large loss, or have little sympathy with the insurance office, who we understand are the substantial plaintiffs in the present action, my duty is to tell you that your sympathy with the company, who are the defendants, if the case is clearly established against them, must not stand in the way of the verdict which law and justice require at your hands. I only say that upon the assumption that, independently of any such collateral considerations whatever, you can see your way safely to a verdict which shall fix the defendants with the negligence which is charged against them. If you do, your verdict ought to be for the plaintiffs; if you do not, it will be for the defendants.

The jury retired to consider their verdict at twenty minutes past two.

Lord Chief Justice COCKBURN inquired what course was intended to be pursued in reference to the second action against the company?

Mr. BOVILL said he appeared for the defendants, and therefore, the decision did not rest with him.

Mr. KARSLAKE, after consulting with his clients, said the record in the other case would be withdrawn.

Lord Chief Justice COCKBURN said he thought that would be the better course, for whatever the result of this action, it would not be convenient to have a similar one tried in the same court.

The Jury having been in consultation for two hours, the learned Judge sent a messenger to them, who on returning said the Jury informed him that they were not likely to agree.

Lord Chief Justice COCKBURN addressing the counsel for the parties said, if the Jury had been likely to agree, he should have been disposed to sit late, for the purpose of taking their verdict, but they had just sent word to him that it was not likely they could agree.

After the lapse of a quarter of an hour, the learned judge said: What shall we do in this case?

Mr. LUSH: The jury say there is no chance of their agreeing.

Lord Chief Justice COCKBURN: That was the last intimation. I will send up again. I think it would be useless to keep them beyond a certain hour.

Mr. LUSH: I think so too.

Lord Chief Justice COCKBURN: We must not be too quick, if there is a hope of their coming to a unanimous verdict; but if they cannot, we may as well release them. [The learned judge then left the court.]

At ten minutes to five o'clock, the jury returned; and his lordship having again taken his seat,

The FOREMAN of the jury said: My lord, in obedience to your wish that we should come down, we have done so: and I may state to you that the jury are divided on the question whether it was the Great Central Company's gas or not which was the cause of the accident. On that question we are divided; but on the second question we are agreed—viz., that the company took ordinary precaution to prevent any accident.

Lord Chief Justice COCKBURN: Then as long as you are agreed upon and find that, on the second point, they took the necessary precaution, that is a verdict for the defendants.

Mr. HAWKINS: The jury only find that the defendants used "ordinary precaution."

Lord Chief Justice COCKBURN: The learned counsel for the plaintiffs directs attention to words which you used—"ordinary precaution."

The FOREMAN: That was the term we agreed to unanimously, and we discussed the matter thoroughly.

Lord Chief Justice COCKBURN: The true issue was, whether they took reasonable precaution, such precaution as prudent men ought to take under the circumstances. As I pointed out to you the fact that they did what is ordinarily done, goes a long way towards the conclusion that what was done was proper to be done. But you cannot, by simply saying that it was what was ordinarily done, avoid the issue really involved, which is, whether, looking at it as reasonable men, you think all was done which, under the circumstances, ought to be done.

The FOREMAN: It was fully discussed by us, and if I might give our reasons, it was thought that it was one of those accidental circumstances which cannot be accounted for.

Lord Chief Justice COCKBURN: If you are agreed on that, it is sufficient.

The FOREMAN: There was a division of opinion upon it, and we thought it better to use the term "ordinary precaution."

Lord Chief Justice COCKBURN: But that is not quite sufficient. That what they did is every day's practice is strong and cogent reason to say that it was reasonable and prudent; but you cannot avoid the question whether what was done was reasonable and right to be done, by saying that it was what people generally do, because persons engaged in a particular sort of business or calling may, from the habit which they have fallen into, do that which is careless and negligent; and if it is really careless and negligent, and some one suffers from it, it is no answer to say it is what every one else does. That will not justify an individual not doing what is right when damage arises. On the other hand, in considering whether the course pursued was a reasonable, right, and proper one, it is a great element in the consideration, and helps you on your way to find that by the unanimous course of proceeding adopted by all other persons under similar circumstances the same thing has been done. That is the only way in which you can look at it. I cannot enter the verdict for the defendants unless you say that under the circumstances what they did was reasonable and right to be done.

The FOREMAN: There was only one gentleman who held out upon that question. As foreman, I may state that the majority of us thought the company ought not to be made responsible.

Lord Chief Justice COCKBURN: If you come to the conclusion, looking at what I have pointed out, that the company did not use proper care and caution, they cannot be exonerated by reason of the conduct of other persons; but if you think, from the evidence you have heard, that the uniform course of proceeding by other companies was to do what they did, that helps you to the conclusion that what they did was all that could reasonably be expected under the circumstances.

The FOREMAN: Probably if we retire again we shall be able to come to a conclusion. There was only one gentleman held that opinion. We shall not detain your Lordship probably more than five minutes.

The jury again retired.

Mr. LUSH asked his lordship to certify for a special jury.

Lord Chief Justice COCKBURN: Oh, certainly.

Mr. HAWKINS applied in case of the verdict being for the defendants for a stay of execution, in order to give him the opportunity of moving the court above.

Lord Chief Justice COCKBURN: I think not. The case has been fully considered whichever way the verdict is found.

At twenty-five minutes to six, the jury again came into court.

The FOREMAN: We are unanimous in coming to a verdict that the company took reasonable precaution.

Mr. HAWKINS then said he would elect to be nonsuited.

Mr. LUSH said he could not agree to that after the verdict had been given.

Mr. HAWKINS said he apprehended that he was at liberty to make the application at any time before the verdict was recorded.

Lord Chief Justice COCKBURN said he was not aware of such a course being adopted after the verdict had been given. If the learned counsel was entitled, as of right to take such a course, having made the application, he would have the benefit of it; but he did not think there was a right.

Mr. HAWKINS said he did not wish it, except he was entitled to it as of right.

Lord Chief Justice COCKBURN: As at present advised, I do not think you are. The jury have now found a verdict for the defendants subject to any application you may make.

Mr. HAWKINS asked that the case might go to the court with some intimation from his lordship.

Mr. LUSH objected.

Lord Chief Justice COCKBURN said he agreed with Mr. Lush that the party who gained a verdict ought not to have his own confidence in that verdict shaken by the judge interposing between the verdict and its legitimate consequence, unless the judge was of opinion that that verdict seriously required reconsideration. He must say that looking simply at this case, without reference to any other, the jury having paid the greatest possible attention to it, the arguments on each side having been exhausted, and he having himself summed up at great length and with some care, he should feel bound, if an application were made to the court to set aside the verdict as against the evidence, not to report in favour of that application. He should report that the case was fully heard out, that he thought it was a most fit case for a jury to decide, and that the jury having paid great attention and showed a full appreciation of the points made had found a verdict against the plaintiffs. That was the view of the matter which he took, and he did not think he could do anything which would seem to sanction an application to set aside that verdict.

Mr. HAWKINS renewed his application for a stay of execution.

Mr. LUSH said he would not press for execution until plaintiffs had had the opportunity of moving the court above.

The verdict was accordingly entered for the defendants.

Miscellaneous News.

ON THE PREPARATION OF ARTIFICIAL COLOURING MATTERS WITH THE PRODUCTS EXTRACTED FROM COAL TAR.

By M. E. KOPP.

[Abridged from the *Moniteur Scientifique.*]

(*Continued from page* 735.)

There is a second aniline compound in which two equivalents of hydrogen are replaced by two equivalents of nitrous acid, dinitraniline = $C_{12}H_52(NO_4)N$. By the prolonged action of sulphuretted hydrogen and ammonia on nitraniline and dinitraniline two new bases are produced—*azophenylamine* and *nitrazophenylamine*. The following equations express the reactions which take place:—

$$\underset{\text{Nitraniline.}}{C_{12}H_6N_2O_4} + 6HS = \underset{\text{Azophenylamine.}}{C_{12}H_8N_2} + 4HO + 6S$$

$$\underset{\text{Dinitraniline.}}{C_{12}H_5N_3O8} + 6HS = \underset{\text{Nitrazophenylamine.}}{C_{12}H_7N_3O_4} + 4HO + 6S$$

The second of these bases, nitrazophenylamine, merits some attention, inasmuch as it offers some resemblance to the coloured derivatives of aniline. It is prepared in the following manner:*—Dinitraniline is boiled for two hours with a great excess of sulphide of ammonium. The liquid soon becomes dark red; the yellow crystals of dinitraniline disappear, and are succeeded by a network of delicate needles, of a deep red colour, the quantity of which is much increased on cooling the liquid after the reaction has terminated. Oxalic and hydrochloric acids dissolve the nitrazophenylamine, leaving the precipitated sulphur, and also a secondary crystallized product of a dirty green colour. The base may be obtained pure by precipitating a boiling oxalic or hydrochloric solution with ammonia and re-crystallizing two or three times from a solution in hot alcohol. In this way nitrazophenylamine is obtained in long slender needles, united in groups, having a clear red colour when dry, and showing a golden irridescence. Water, alcohol, and ether easily dissolve it, and the concentrated solutions are of a deep red colour. It melts at a high temperature, and the greater part is volatilized apparently without alteration. Heated suddenly, it slightly explodes, leaving a carbonaceous residue.

The salts of nitrazophenylamine are very beautiful compounds, characterized by a dichroism which causes a peculiar irridescence in reflected light. All the salts must be crystallized in the presence of an excess of acid, since both water and alcohol decompose the neutral salts

Fuschine prepared by chloride of tin, according to the process of MM. Renard and Franc, appears to be the hydrochlorate of a base, the properties of which greatly resemble those of nitrazophenylamine. The crystallized salts show the same coloured reflections, and are decomposed (in part at least) by water and alcohol, the solutions being of a deep red colour.

We now proceed to notice the processes for the preparation of colouring matters by means of aniline, and the method of employing them for dyeing fabrics and yarns.

The first on the list is that of Mr. Perkin, for the preparation of aniline, violet or mauve. A cold solution of sulphate of aniline (rough aniline is used) and a cold solution of bichromate of potash are mixed together and left for ten or twelve hours An abundant deposit of a black powder is thus obtained, which is separated, well washed with water, and, lastly, dried at 212°. The dried substance is then digested several times with naphtha or commercial benzole, which dissolves a brown tarry or resinous substance, contaminating the colouring matter in the deposit. The residue insoluble in the naphtha is dried again, and then digested with wood spirit or alcohol, or any other liquid able to dissolve the colouring matter. This clear solution is decanted and distilled to recover the solvent. The residue of the distillation is anileine, or aniline violet.

Mr. Perkin gives the following directions for dyeing with anileine:—To dye a lilac or purple, an alcoholic solution of the colouring matter is added to a boiling dilute solution of oxalic and tartaric acids, and when the mixture has cooled, the materials to be dyed (silk, cotton, &c.) are to be completely immersed in the bath. Mr. Perkin's patent is dated Aug. 26, 1856. In the early part of 1859 M. Verguin, a chemist at Lyons, while experimenting with aniline, discovered a process for converting it into a magnificent purple-red colouring matter. M. Verguin sold his process to MM. Renard and Franc, who patented the process in France on the 8th of April, 1859, and gave the new colouring matter the name of fuschine. The process is as follows:—A mixture of ten parts of aniline with six or seven of anhydrous chloride of tin is boiled for fifteen or twenty minutes. The mixture at first turns yellow, then becomes reddish, and ends by assuming a beautiful red colour when seen in thin layers; in the mass it appears black. Water is now added, and the whole is heated to ebullition. It is then removed from the fire, allowed to rest a moment for some insoluble matters to deposit, and then filtered while still hot; the residue is exhausted by another boiling with water. The filtered liquor contains the colouring matter in solution. To separate it advantage is taken of its being insoluble in a saline solution; accordingly, chloride of sodium or a neutral tartrate of potash or soda, in a solid state, is added to the liquor, and as the salt dissolves the colouring matter is deposited. It may then be separated by decantation or filtration.

Fuschine may be employed for dyeing either in aqueous solution, without a mordant, or with the ordinary saline or acid mordants, always excepting the mineral acids which alter the colour.

A red colour is also obtained by acting on aniline with other anhydrous metallic chlorides—bichloride of mercury, perchloride of iron, protochloride of copper, for example. In October, 1859, MM. Renard and Franc added to the above three anhydrous chlorides the hydrate of bichloride of tin, as being equally able to change aniline into fuschine. A second addition to the patent, in November, 1859, extended the list of colorigenous agents by including the stannous and stannic sulphates, the mercurous and mercuric sulphates, mercurous and mercuric nitrates, nitrate of silver, titanic chloride, mercuric fluoride, stannic and mercuric bromides, and stannic iodide. A third addition, in the same month, added the ferric and uranic nitrates, uranic chloride and mercuric chlorate, bromate, and iodate. Sesquichloride of carbon and iodoform were afterwards added in December of the same year. Lastly, a fifth addition was made in February, 1860, the purport of

* Gerhardt, *Chimie Organ.* iii., p. 105; Gmelin's "Handbook," xi., p. 294.

which the author does not exactly know, but which, he believes, includes iodine, arsenic acid, and nitrict acid.

We must here quote from the paper by Dr. Hofmann, presented to the Academy of Sciences, on September 20, 1858,* and entitled, "Contributions to the History of the Organic Bases: IV. Action of Bichloride of Carbon on Aniline":*—

"At the ordinary temperature of the air, aniline and bichloride of carbon do not act on each other. At 100° C. the mixture begins to change; but after digesting for some days, the change is far from being complete. By submitting, however, a mixture of one part of bichloride of carbon and three parts of aniline, the two bodies being in the anhydrous state, to a temperature of 170° or 180° (the boiling point of aniline) for nearly thirty hours, the liquid is changed into a blackish mass, soft and viscous, or hard and brittle, according to the duration of the temperature. This blackish mass is a mixture of several bodies. By exhausting with water a part is dissolved, another part remaining insoluble in a resinous state. With the aqueous solution potash gives an oily precipitate, which contains a considerable proportion of unchanged aniline. On distilling this oily matter with diluted potash, aniline passes; while a viscous oil, which solidifies by degrees, remains behind. Repeated washings with cold alcohol, and one or two crystallizations from boiling alcohol, render the body perfectly white and pure; a very soluble substance of a *magnificent crimson colour* remaining in solution.

"The blackish portion of the mass which remains insoluble in water, is easily dissolved by hydrochloric acid; from this solution it is again precipitated by alkalies, as a dirty-red amorphous powder soluble in alcohol, and forming a *rich crimson-coloured solution*. The greater part of this colouring matter is the same as that which accompanies the crystalline fatty body, considerable quantities of this latter substance being sometimes found in the product insoluble in water."

The great resemblance between the experiments of Dr. Hofmann and the process of MM. Renard and Franc is evident. If, as appears from the fourth addition to their patent, fuschine may be prepared by boiling sesquichloride of carbon with aniline, it is quite clear that Dr. Hofmann had fuschine in his hand, and that it is identical with the substance which gave a magnificent crimson solution. It is right, however, to add, that if Dr. Hofmann was the first who obtained fuschine as a secondary product in his theoretical experiments, M. Verguin has certainly the merit of having modified the process, so as to make it capable of industrial application.

In October, 1859, M. Gerber-Keller patented in France the preparation of a red colouring matter, which he called Azaleine, "by means of aniline treated under the influence of heat, and in proper proportions with several salts which are formed by the oxyacids of nitrogen, sulphur, chlorine, bromine, and iodine with metallic oxides." We shall complete this too concise and consequently obscure description of the process by adding what is known respecting the preparation. The salts preferred by the author are the mercurous and mercuric nitrates. Aniline is carefully heated to about 150° C., and nitrate of mercury in powder is then dropped in, a small quantity at a time. A higher temperature than 150° must be avoided, or the action becomes too violent, and the colouring matter is destroyed. At every addition of the mercury salt a sort of ebullition is produced, the consequence of the reaction which takes place; metallic mercury is deposited at the bottom of the vessel, and the liquor gradually acquires a deep crimson colour. After being decanted, the whole is allowed to cool, and the colouring matter is now washed with a little water and dried. It is then freed from tarry matters by repeated washings with commercial benzine, and finally dissolved in alcohol or wood spirit, the solution being re-precipitated with water, &c., again and again until the product is sufficiently pure. Absolute purity is not necessary for either dyeing or printing.

Azaleine is soluble in water, but much less so than in alcohol. For dyeing silk and wool, alcoholic solutions are preferred: for printing on cotton, a dilute alcoholic is thickened with gum.

We have recently heard that the process now employed by M. Gerber-Keller is the following—ten parts of aniline are heated on a water bath to 100°, and seven parts of mercuric nitrate, dry and in powder, are added by degrees. The mixture is maintained at the temperature of 100° for eight or nine hours, in which time the mass will have become of a magnificent violet-red colour. On cooling, it forms a thick paste. The greater part of the reduced mercury is found at the bottom of the vessel. To employ the azaleine then produced as a dye or for printing, it is only necessary to treat the pasty mass with boiling water, a mixture of water and alcohol, acetic acid, or any other solvent, and make use of the solution.

The advantage of the last process consists in the moderate heat required, a high temperature seeming to cause the formation of tarry matters.

Mr. Albert Schlumberger has also described (*Bulletin de la Société Industrielle de Mulhouse*, March, 1860, p. 170) a process for converting aniline into a red colouring matter by means of the neutral nitrate of mercury. He takes 100 parts of anhydrous aniline, and 60 parts of the nitrate of mercury, and heats the mixture to boiling. The mass slowly changes colour, at first becoming brown, but in time the whole is transformed into a beautiful red liquid. The operation is finished when the boiling materials are observed to swell up and disengage yellowish vapours. The mass so obtained is washed with two or three times its volume of boiling water, to remove the oils which are not completely metamorphosed, and then boiled two or three times with water to extract the colouring matter.

In this process, as well as in the preceding, the whole of the mercury is recovered.

In May, 1860, MM. Girard and Delaire obtained a patent for the use of arsenic acid in the preparation of a red colouring matter from aniline. They introduce into a distillatory apparatus twelve parts of dry arsenic acid and twelve parts of water. When the hydration of the arsenic acid is complete, they add ten parts of aniline, and shake the whole well together. The mass becomes homogeneous, pasty, and almost solid. A gentle heat is then applied, so as to raise the temperature of the mixture gradually. The mass now becomes liquid. When the operation is properly conducted, only water and a very small quantity of aniline distil. At 120° a great part of the aniline is changed into the colouring matter, and care must be taken to keep the mixture at this temperature for some time. The heat may then be increased, and it must never pass 160°. The operation lasts four or five hours.

In the above way a perfectly homogeneous mass is obtained, which is fluid above 100°. On cooling it solidifies, and has the appearance of a hard, brittle substance, with a bronze lustre. It is very soluble in water, to which it communicates a pure red colour, so deep that concentrated boiling solutions appear black. The solutions may be used for dyeing directly without fear, for the tissues will not retain a trace of the arsenic. If necessary, the arsenic may be easily removed from the colouring matter by one of the following processes:—

1. Powder the rough product and treat it with strong hydrochloric acid; then dilute with water, and saturate the clear solution with a slight excess of soda. The colouring matter is precipitated, while the arsenic remains in solution in the alkali, and it is only necessary to wash the precipitate once or twice with cold water to obtain the colouring matter quite pure.

2. The rough product dissolved in water is treated with a quantity of quick lime corresponding to the arsenical compounds it contains, *plus* a slight excess. The colouring matter is precipitated, as well as the arsenical compounds—the latter in the form of insoluble calcareous salts. The liquor and the precipitate (unseparated) are now treated with carbonic, acetic, or tartaric acid, either of which will dissolve the colouring matter and leave the arsenic.

In this process, aniline gives about its own weight of colouring matter.

The process of MM. Depouilly and Lauth, "for the manufacture of various coloured products derived from aniline," is very similar to that of Mr. Perkin. They take a solution of a salt of aniline and treat it with a solution of chloride of lime. The first drops of the chloride produce a violet colouration, and, on continuing the addition of the re-agent, a deep violet precipitate is formed, which constitutes the colouring matter. This is collected and washed with slightly acidulated water. When the washings are uncoloured, the precipitate is collected on a filter, and drained. It is then dissolved in a strong acid—sulphuric for example—and re-precipitated by the addition of a large quantity of water, or by an alkaline solution. The product is thus obtained sufficiently pure for sale. For dyeing and printing, alcoholic acid or aqueous solutions may be used, according to the nature of the article to be dyed and the purity of the colour required.

(*To be continued.*)

* *Comptes-Rendus*, t. xlvii., p. 492.

LIGHTING SHIPS WITH GAS.—The *Times* says, that one of Major Fitzmaurice's gas apparatus has been erected in the steam-factory at Woolwich Dockyard by order of the Board of Admiralty, and has been put into operation experimentally for the purpose of testing its availability for supplying the ships of Her Majesty's fleet and the service generally with gas, in which case one of the apparatus will be fitted in the engine-room of each vessel, to supply the burners fixed in the various compartments of the ship in a similar manner to that on shore. The gas is termed "olefiant" gas, being made from any kind of oil, grease, bones, cocoanut, fat of every description, or even shavings, peat, wood, &c., and the apparatus may be managed with perfect safety by a mere lad, so extremely simple are its arrangements. The lights were pronounced of a greater brilliancy than the common gaslights, being at the same time free from smoke, and the flame was observed to be of a thicker and stronger quality, although the heat produced was considerably less. The gas will continue in use for a short time in the factory, experimentally, in order to obtain a correct testimony of its superiority, for their Lordships' approval. The Birkenhead Commissioners are also trying the experiment of lighting the cabins of their river steamers with gas, a quantity of which will be carried on board each steamer daily.

REPORT ON THE GAS OF THE SURREY COMPANY.—Dr. J. Northcote Vinen, the medical officer of health for the St. Olave's district, Southwark, transmits us the following report on the gas supplied by the Surrey Consumers Company for the last four weeks:—

Week ending	Number of Observations.	Maximum Light. Candles.	Minimum Light. Candles.	Average Light. Candles.
Nov. 24	4	13·20	12·22	12·91
Dec. 1	4	13·77	10·66	12·21
„ 8	4	14·12	12·83	13·51
„ 15	4	15·81	14·21	14·84

The value of the hydrocarbons varied from 4 to 5 per cent. Carbonic acid was present to the extent of 1 per cent. On the 4th, 6th, and 14th inst., there was distinct evidence of the presence of ammonia. The maximum pressure was three inches and two-tenths; the minimum four-tenths of an inch; and the average ordinary pressure was one inch.

[ADVERTISEMENT.]

TO THE SHAREHOLDERS IN THE WHITEHAVEN GAS COMPANIES.

GENTLEMEN,—I have from time to time made unavailing efforts to bring about an accommodation between the two Gas Companies in Whitehaven, which, as you know to your cost, have now been engaged six or seven years in the most determined efforts to ruin each other—the one selling gas at 2s. 6d. per 1000 feet, and the other at 2s. The result of this state of things is, that more than £20,000 of capital expended on the works of the two companies have been rendered during all that period totally unproductive; and, unless the shareholders of the two companies will take the trouble to bestir themselves, this most absurd competition is likely to continue for some years to come.

There is not, in my mind, a doubt that the establishment of the new or consumers' company, in or about the year 1853, was a most uncalled-for proceeding. There was nothing that I have ever been able to learn in the charges or conduct of the old or original concern which justified the establishment of a new company. The management of the old company was, as it still is, indifferent; and gas of a low illuminating power was, as it still is, supplied to the consumers; nevertheless, there was no need of a new company. The place and the population never required it. Nothing could be expected from it but the depreciation or waste of the capital of both companies, and the generating in the town of bitter animosities. I have always felt more than surprised that some gentlemen of intelligence and position in the place should ever have lent themselves and aided in the establishment of the new company. I have never been able to ascertain that there was any reasonable justification for a movement so hostile to the property of others.

Having, as a shareholder in the old company, stated all this, I must beg to be allowed to express my conviction that the directors of both companies have been, and still are, much more unbending, and much more implacable in their resentments, than is consistent with the duties they owe to their respective constituents, the shareholders. The directors of the old company must now see, what has been very obvious for some years past, that their continuing to charge 2s., whilst the other company sell at 2s. 6d., is an unnecessary sacrifice of the interests of their proprietary. They must also now see that they cannot extinguish their rival, and that common sense, and a considerate regard for the interests of their shareholders, alike suggest that it would be better to amalgamate on fair terms than to persist in rendering unproductive £10,000 of the capital of their proprietary, merely for the gratification of feelings of anger and resentment.

Some of the directors in both concerns have a very insignificant amount of capital invested in the shares of their respective companies. In the old company, some of the most implacable and impracticable of them have really a very trifling stake indeed; and it has always appeared to me that

the gratification of passion, rather than a regard for the interests of their proprietary, has influenced them from the commencement of this competition down to the present hour. I am quite certain, it would be greatly to the advantage of the shareholders if some of the gentlemen who constitute the two boards of direction would be good enough to retire, and to allow their places to be occupied by others who could bring to the discharge of their duties, and especially to the subject of amalgamation, a better temper, and a better intelligence and tact, than they have ever yet displayed. It is impossible that any change could be made for the worse; and I therefore beg you to come forward in a body, and to ask the present directors opposed to amalgamation to be good enough to retire, and to allow some other gentlemen less under the influence of temper to occupy their places, and to arrange the terms of a "unification" of the two concerns.

If the matter were referred to a gas engineer of good standing, he would at once be able to propound terms which would do justice to all parties concerned. Unquestionably, it is high time for you to bring this malignant contest to an end, and to make an effort to recover the money you have invested.

It is rather too much to be borne that two or three tolerably well-to-do individuals—retired from business, and with a very small stake in the concern, and very little occupation—should be allowed to amuse their leisure, and to extract gratification, year after year, in keeping alive this senseless competition. If they were actuated by any proper regard for your interests, they would not persist in it.

Hoping that some of you on the spot will respond to this appeal, and take the matter up in an earnest manner, I am, gentlemen, your obedient servant,

JOHN MAUGHAN.

Leamington, December 5th, 1860.

Price Current.

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Average Weight of Cast-Iron Gas-Pipes, per Yard.

1¼ in.	2 in.	2½ in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.
16	21	28	33	51	70	89	107	126	149	177	208 lbs.

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	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Pig Iron, No. 1	3 5 0	2 12 6	2 12 6	3 0 0	3 5 0
1½ and 2 inches Socket-Pipes	7 0 0	6 0 0	6 5 0	6 10 0	6 15 0
2½ and 3 ,, ,,	6 10 0	5 10 0	5 15 0	6 0 0	6 5 0
4 and 5 ,, ,,	6 0 0	5 0 0	5 5 0	5 10 0	5 15 0
6 in. and upwards ,,	5 15 0	4 15 0	5 0 0	5 5 0	5 10 0
Retorts, 1st fusion, hot blast	5 10 0	4 10 0	4 15 0	5 0 0	5 5 0
,, 2nd ,, cold ,,	6 10 0	5 5 0	5 10 0	6 0 0	6 5 0
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WROUGHT-IRON TUBING,

Subject to 40 per cent. Discount.

	2 in.	1½ in.	1¼ in.	1 in.	¾ in.	½ in.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Patent Welded Tubes, from 2 to 12 ft., perft.	1 8	1 0	0 10	0 7	0 5	0 4½
,, ,, ,, 6 in. to 18 in., each	3 0	2 0	1 9	1 3	1 0	0 9
Connecting-Pieces, or Long Screws	3 6	2 3	2 0	1 6	1 2	0 11
Bends, Springs, and Elbows—wrought iron	3 9	2 3	1 9	1 0	0 10	0 8
Tees, wrought or cast	4 0	2 6	2 0	1 6	1 1	0 10
Crosses, wrought or cast	4 6	3 0	2 6	2 0	1 6	1 2
Iron Cocks	17 6	9 6	7 6	4 6	3 3	2 6
,, with brass plug	28 0	16 0	13 0	7 0	5 6	4 6
Diminishing Sockets, Caps, Plugs, and Plain Sockets [Nipples	1 3	0 9	0 8	0 6	0 5	0 4
	1 0	0 8	0 7	0 5	0 4	0 3
Syphons, 2 quart	15 0	14 0	13 6	13 0	12 0	—

COALS, PER TON.

Newcastle.—Unscreened.	6s. 9d.
Whitwell Primrose	
Medomsley, Eighton Moor, and Burnhope	7 0
Pelaw	7 3
New Pelton, Peareth, South Pelaw, Washington Hutton, and South Peareth	7 6
Pelton	7 9
Ramsay's Newcastle Cannel	16 0

Scotch Cannel.	45s. 0d.
Boghead, at Leith	23 0
Kirkness, best	20 0
Capeldrae, 1st quality	12 6
,, 2nd ,,	25 0
Lesmahago, at Glasgow	27 6
,, ,, Leith	27 6
Arniston	20 0
Wemyss	18 0
Knightswood	15 0
Pirnie	

FREIGHTS.

Coastwise—Newcastle.—Per Ton.	8s. 6d.
Chatham & Rochester	11 0
Cork	8 6
Dover	11 6
Dublin	10 6
Exeter Quay	8 6
Folkestone	9 0
London (Pool)	6 6
Lowestoft & Yarmouth	—
Lynn	9 6
Portsmouth	10 0
Plymouth	8 6
Ramsgate & Margate	8 0
Whitstable	10 0
Weymouth	

Foreign.—Per Keel.	£9 0 0
Boulogne and Calais	24 0 0
Barcelona	15 0 0
Bordeaux	15 10 0
Cadiz	13 0 0
Copenhagen	11 0 0
Dieppe	23 10 0
Genoa	13 0 0
Hamburg	12 5 0
Havre	23 0 0
Leghorn	17 0 0
Lisbon	12 0 0
Rotterdam	10 0 0
Stettin	24 0 0
Trieste & Venice	

SUNDRIES.

Best Newcastle Fire-bricks	per 1000	50s. 0d.	
Cliff's Fire-bricks, at Wortley	per 1000	55 6	
Ingham's Fire-bricks, at Wortley	,,	55 6	
Fire-clay Retorts	per foot run, 5s. 6d. to	7 0	
Tough Cake Copper	per ton	£102 10s.	
English Pig Lead	,,	21 5	
Welch Bar Iron, in London	,,	6 12 6	
Tarred Rope Yarn	per cwt.	26s. 0d.	

Foreign Spelter	per ton	£20 0 0
English Block Tin	,,	136 0 0
Banca	,,	135 10 0

Advertisements.

WHITEHOUSE and CO., Boiler and GASHOLDER MAKERS,

GLOBE PATENT TUBE WORKS, WEDNESBURY,

Beg to draw the attention of Engineers and Managers of Gas Works to the superior quality of the Article they manufacture, both in respect of the iron employed, and the perfect manner in which it is welded; in proof of which they can refer to the testimonials of the most eminent Gas Engineers, and the experience of the principal of the large Gas Companies of the kingdom.

Orders promptly executed.

TO Mr. BENJAMIN WHITEHOUSE, GASHOLDER MAKER, WESTBROMWICH, NEAR BIRMINGHAM.

Sir,—I feel great pleasure in expressing my satisfaction at the manner in which you discharged your duties as CONTRACTOR for the TELESCOPIC GASHOLDER, 150 feet diameter and 60 feet deep, erected at this Company's Nine Elm Station in 1857. From that period to the present I have closely watched its working, and have never found the least defect either in workmanship or material.

During the recent heavy gales the Gasholder, although containing upwards of 1,000,000 cubic feet of Gas, showed no perceptible indications of its influence, but worked as freely and easily as usual.

RICHARD JONES.

Engineer to the London Gaslight Company.

Vauxhall, London, Nov. 9, 1859.

SAMUEL CUTLER, Gasholder MAKER and CONTRACTOR

For Tanks, Roofs, Purifiers, Condensers, Erection and Alteration of Works and every description of GAS APPARATUS.

PROVIDENCE IRON WORKS, MILL WALL, POPLAR, LONDON, E.

Main Laying and Gas-Works erected complete.

BELGIAN CLAY RETORTS.

ALBERT KELLER, Ghent.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Albert Keller, of Ghent, begs to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by him. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications, addressed to ALBERT KELLER, GHENT, will receive immediate attention.

THOMAS W. ALLSOPP, GAS ENGINEER AND CONTRACTOR. **CASTLE DONINGTON, NEAR DERBY,**

Manufacturer of every description of Gas Apparatus, Gasholders, Boilers, &c.

ADDISON POTTER, WILLINGTON QUAY, NEAR NEWCASTLE-UPON-TYNE,

Manufacturer of Clay Retorts, Fire Bricks, and every description of Fire Clay Goods.

JOSEPH CLIFF and SON, FIRE-CLAY WORKS, **WEST DENTON, NEWCASTLE-ON-TYNE,**

Manufacturers of Clay Retorts, Fire-Bricks, Lumps, Tiles, &c.

The seam of Clay from which these goods are made is noted for its fire-resisting properties. Prices very moderate.

Office, 52, Quay Side, Newcastle-on-Tyne.

ROBERT MACLAREN and CO., EGLINTON FOUNDRY, GLASGOW,

Manufacturers of all sizes of Cast-Iron Main Pipes, by an improved Patent. General Ironfounders, Gas Engineers, and Wrought-Iron Tube Makers.

M. SHEEN, Gas and Railway Lantern Maker, 90½, Holborn Hill, begs to inform Managers of Gas-Works, &c., that she continues to contract and supply Lanterns on reasonable terms, and keep them in repair by the year.

WIGAN Gas Cannel and Coals, also SCOTCH BOGHEAD AND PIRNIE, for Manufacturing Gas and Oils.

Analyses, and other particulars supplied on application to

EMANUEL TURNER and CO., EXPORT COAL OFFICES, &c., 34, CASTLE STREET, LIVERPOOL.

COUNTY and General Gas Consumers COMPANY (LIMITED).—Works at Chertsey, Lea Bridge, Northfleet, Pembroke, Pembroke Dock, Ware, and Walton-on-Thames, producing a gas rental of about £6500 per annum.

Established for the erection of gas-works in provincial towns, or the purchase or leasing of existing works on equitable terms. Application to be made to the Engineer to the Company, Mr. H. F. STEPHENSON, 58, PALL MALL.

TO GAS COMPANIES AND OTHERS.

MR. HANSOR begs to inform Gas Companies, Contractors and Others, that he has invented and Patented a New Method of Manufacturing Gas from Coals, which will yield the following important advantages—viz., NO formation of CARBON in the Retorts; Bisulphide of Carbon will NOT be generated; an increase of Gas, with greater illuminating power, and the Coke uninjured; saving of Fuel, Labour, and Retorts, with other advantages.

Estimates for the Erection of New Works, or the alteration of old arrangements, on application to the INVENTOR, at No. 2, Portland Place, Wandsworth Road, LONDON; or to Mr. WILSON, Engineer, Unity Buildings, 8, Cannon Street, LONDON, E.C.

EIGHTON MOOR GAS COALS.—Parties wishing to be supplied with these first-class Gas Coals will please to apply to Mr. MATTHEW NESBIT, EIGHTON MOOR OFFICE, NEWCASTLE-UPON-TYNE. These coals are well known as among the richest in gas, and working the roundest on the River Tyne. They are extensively used by metropolitan gas works.

GEORGE BOWER, GAS ENGINEER, MANUFACTURER, AND CONTRACTOR, **ST. NEOT'S, HUNTS.**

References to between 100 and 200 Gas-Works Designed and Erected by the Advertiser.

WILLIAM STEPHENSON & SONS THROCKLEY, NEWCASTLE-ON-TYNE,

MANUFACTURERS OF EVERY DESCRIPTION OF **FIRE BRICKS, CLAY RETORTS, LUMPS, TILES,** &c. &c.

LONDON OFFICES: 76, KING WILLIAM STREET, CITY.

A large stock of Fire-Clay Goods always on hand in London, at the lowest wharf prices, at Messrs. CHRISTIE & Co.'s Wharf, 64, Bankside, SOUTHWARK.

WEST and GREGSON, Gas-Meter MANUFACTURERS, &c. UNION STREET, OLDHAM.

Station and Experimental Meters, Gas Pressure Registers, Gauges, Experimental Gasholders, Governors, Slide Valves, &c. &c.

W. and G. would respectfully call the attention of Gas Engineers and Managers to their Station-meters, having made and erected the largest in use at the present time, two of which may be seen at the Stockport and Liverpool Gas Works, on application to the respective Engineers.

PERRENS & HARRISON,

THE LYE FIRE-CLAY AND BRICK-WORKS, STOURBRIDGE,

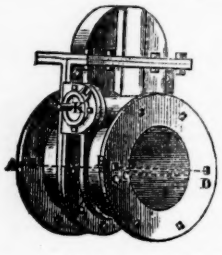
Successors to the late firm of J. and W. KING,

and Sole Proprietors of their well-known CLAY MINES, are prepared to supply

GAS-RETORTS, CLIFT'S PATENT GAS-OVENS and FIRE-BRICKS

OF ALL DESCRIPTIONS,

the superior quality of which will, they are confident, secure them further orders.



BRYAN DONKIN & CO.

keep always on stock their

IMPROVED GAS VALVES

from 2 inches to 18 inches, price 11s. 6d. to 13s. 6d. per inch diameter

List of prices, with full dimensions of all sizes up to 27 inches, to be had on application.

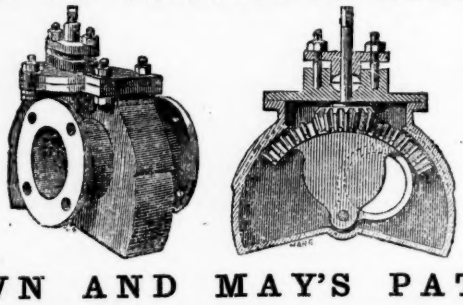
These Valves are all proved to 30 lbs. on the square inch before leaving the works.

BRYAN DONKIN & CO.,

ENGINEERS,

NEAR GRANGE ROAD, BERMONDSEY.

BEST AND CHEAPEST SLUICE-COCK.



BROWN AND MAY'S PATENT.

Above 3-inch diameter, price 10s. per inch. Brass face, 6d. per inch extra.

Can be taken to pieces without being removed from the line of Piping.

NORTH WILTS FOUNDRY, DEVIZES.

Wholesale Agents, Messrs. S. and E. RANSOME, 31, Essex Street, Strand, E.C., Where a Sample may be seen.

WALTER FORD,

LATE

PADDON and FORD,

GAS-METER AND APPARATUS WORKS,

GRAY'S INN ROAD, LONDON.

MANUFACTURER OF WET AND DRY GAS-METERS, STATION-METERS, GOVERNORS, &c. &c.

A large number of **STATION-METERS,** up to 80,000 feet per hour (being by far the largest in use), and **GOVERNORS** for **MAINS,** up to 24 inches, have been constructed by Paddon and Ford. These Meters and Governors possess peculiar advantages as regards strength and freedom of action.

Sole Manufacturer of **PADDON'S PATENT STREET-LAMP REGULATORS,** for insuring any required consumption. These Regulators are in general and increasing use, and references can be given to Gas Companies who use them for every Lamp.

WOLVERHAMPTON RETORT WORKS.

ESTABLISHED **1840.**

JOHN EUNSON AND SON,

GAS ENGINEERS, AND MANUFACTURERS OF CLAY RETORTS,

AND FIRE GOODS IN GENERAL,

WOLVERHAMPTON.

Retort Mouthpieces, Bolts, Nuts, and every description of Wrought-Iron Work.

F. & C. OSLER,

45, OXFORD STREET, LONDON;

Manufactory—Broad Street, Birmingham—Established 1807,

MANUFACTURERS OF GLASS CHANDELIERS, GLASS LUSTRES, TABLE GLASS, &c. &c.

ELEGANT CRYSTAL GLASS CHANDELIERS, for GAS, from £4 upwards

(Made from "REGISTERED" DESIGNS), with GLASS BRANCHES, &c.; suitable for DRAWING-ROOMS and BALL-ROOMS. The more extensive use of GAS in private dwellings has induced Messrs. OSLER to direct their particular attention to the manufacture of this class of articles—which, with a view to their general adoption, are offered at very moderate prices. Purchasers can select from a great variety of patterns, to which additions are being constantly made.

THEATRES, CONCERT, ASSEMBLY, AND BALL ROOMS LIGHTED BY ESTIMATE ON THE LOWEST TERMS.

JAMES OAKES and CO.,

ADFRETON IRON WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 20, WHARF ROAD, CITY ROAD, LONDON,

Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water Works, including best cold-blast Iron Retorts, Socket and Flange Pipes of all sizes, Bends, Branches, Syphons, Lamp Columns of various patterns, &c.

N.B.—Orders for Cast-iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention.

CHARLES HORSLEY, Agent.

C. H. is prepared to carry out the warming and ventilation of public buildings, &c.; also civil engineering in general.

BIRTLEY IRON WORKS,

CHESTER-LE-STREET,

DURHAM.

Manufactory for every description of Casting and Machinery for Gas Works and Water Works.

Warehouse in London for Cast-iron Pipes and Connections of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Office in London, Mr. E. M. PERKINS, 78, Lombard Street.

JOHN ROGERSON and CO.,

NEWCASTLE-ON-TYNE & MIDDLESBRO'-ON-TEES.

Wrought and Cast Iron Pipes, Cast-Iron Retorts, and all kinds of Foundry Work necessary for Gas-Works. Fire-Bricks and Clay Retorts. Gas Coals of every description. Pig, Bar, and Plate Iron.

LONDON HOUSE:

12, ROYAL EXCHANGE BUILDINGS.

WROUGHT-IRON Guides for Gas-

HOLDERS, when Trussed upon scientific principles, are more capable of resisting strains, in every direction, than Cast Columns of any form can be; and weigh only one-fifth as much as the latter. Designs and Working Drawings for Guides and Ties can be obtained of the Inventor, CHARLES DIXON, C.E., Chichester, SUSSEX.

GAS COAL.

BEAL, WALKER, and CO., Coal and

COKE MERCHANTS, No. 1, Walker's Buildings, SHEFFIELD, beg to inform the Directors and Managers of Gas Companies, that they are in a position to contract for the supply of the different sorts of best Gas Coal, such as best Silkstone, Barnsley, and others, at the lowest prices, which may be had on application at the above Office.

ALFRED PENNY, Engineer,

WENLOCK IRON WORKS,

WHARF ROAD, CITY ROAD, LONDON.

Mr. PENNY begs to inform Gas and Water Companies that he undertakes the erection of new, or the alteration of existing, works; and that he may be consulted generally on all matters connected with gas and water supply. He is also prepared to supply best Cold-blast Retorts, Socket-Pipes, and Connections, Iron Borings, &c. &c., and all the necessary Castings used in Gas and Water-Works.

*** Country orders executed with care and despatch.

JOSEPH WILLCOCK

(late BARLOW and CO.),

Mechanical and Architectural Draftsman, Designer, Surveyor, an Lithographer to Gas Engineers and Gas Apparatus Manufacturers, formerly Superintending Engineer at the largest Gas Apparatus Manufactory on the Continent.

Patent and Designs Office, 89, Chancery Lane, LONDON, W.C.

GEORGE ANDERSON, Gas and

CONSULTING ENGINEER,

104, LEADENHALL STREET, LONDON (E.C.).

DIRECT-ACTING GAS-EXHAUSTERS,

supplied either with or without Steam-Engines and Boilers.

FOUR-WAY DIAPHRAGM VALVES,

one of which answers the purpose of THREE ordinary Valves, as applied to Purifiers, or in shutting off and passing Station-Meters, Governors, or other apparatus, while the Connecting-Pipes are also much simplified.

RETORT SETTINGS,

designed to be heated by Tar alone, and with a total absence of Smoke.

Illustrated circulars, giving references and every information, may be obtained on application as above.

BENJAMIN GIBBONS, Jun.,

DEEPDALE FIRE-CLAY & BRICK WORKS,

Near DUDLEY,

Manufacturer of every description of Fire-Bricks, Lumps, Quarries, Shields, Flue Covers, &c., to any size or shape required.

FIRE-CLAY RETORTS,

TO MODEL OR DRAWING.

B. G. begs to call the attention of Gas Companies to his Fire-Clay Retorts, which have been used with great satisfaction in some of the largest Gas-Works in the Metropolis and many Provincial Towns in England.

References given, if required.

CAST-IRON Retorts, Socket Pipes, with Syphons and all requisite Connexions, Lamp Columns, Wrought Iron Tubing, Valves, Street Lamps, Sight Holes, Furnace Doors, Ash Pans, Charging and Coke Shovels, Iron Pails and Coke Barrows, Cross Bars, Fire Pots, Pumps, Iron Borings.

PURIFIERS, CONDENSERS, and SCRUBBERS erected complete, or the materials supplied; with every description of goods in use by Gas-Works, in stock, on wholesale prices, at

Mr. LYNCH WHITE'S,
Old Barge Iron Wharf, Upper Ground Street,
LONDON.

FLEXIBLE GAS TUBING,
VULCANIZED INDIARUBBER HOSE-PIPES,
WASHERS FOR STEAM-JOINTS, &c.

JAMES LYNE HANCOCK begs to inform the trade he has considerably improved the manufacture of his FLEXIBLE TUBING, both PLAIN and GLAZED. Made all sizes in 60 feet lengths.

INDIARUBBER GAS BAGS, fitted complete with Stop-Cocks and Tubes.

All orders to be addressed to JAMES LYNE HANCOCK, Vulcanized Indiarubber Works, Goswell Road, (opposite Spencer Street) LONDON (E.C.).

WALTER MABON, Engineer,
ARDWICK IRON WORKS, FAIRFIELD STREET
MANCHESTER,
Manufacturer of

IRON TANKS for Gasholders, Railway Stations, &c.

GASHOLDERS.—Extensive premises at Gorton, solely for the manufacture of Gasholders, and other heavy Wrought-Iron Structures.

GAS APPARATUS.—W. M. has an extensive assortment of patterns for Purifiers from 4 feet to 15 feet square, also round ones from 4 feet to 10 feet diameter; Scrubbers, Condensers, Washers, Columns, Girders, and Tripod Patterns, suitable for Gasholders, from 10 feet to 150 feet diameter, either Single-lift or Telescope. Contractor for Gas Works of any Magnitude. Designs, Specifications, and Estimates furnished.

WROUGHT and CAST IRON ROOFS for Railway Stations, Gas Works, Warehouses, and Sheds, prepared for Slates or for Corrugated Iron.

IRON HOUSES, either for Dwellings, Manufactories, or Public Buildings.

PIPES and VALVES, for Gas and Water, from 2 inches to 48 inches bore.

WILLIAM BLEWS AND SONS'
IMPROVED MACHINE-MADE BURNERS,
WROUGHT-IRON BATSWINGS,
FOR RAILWAY STATIONS AND MARKETS,
GAS-FITTINGS, CHANDELIERS,
BRASS AND IRON TUBES OF EVERY KIND,
SUPPLIED ON THE BEST TERMS,
AT THE WORKS,
9, 10, 11, BARTHOLOMEW STREET,
BIRMINGHAM.

JAMES NEWTON,
(Established 1820,)
FIRE-BRICK AND TILE MERCHANT,
Wholesale and for Exportation,
FALCON DOCK, 78 AND 79, BANKSIDE,
SOUTHWARK, LONDON.
DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and CLAY,
and every Article suitable for
GAS AND WATER WORKS.

Gas Stoves, Gas Baths, Gas Cooking APPARATUS, warranted the best in England, at PHILLIPS'S, the original inventor and manufacturer, and general gas-fitter, &c., 55, Skinner Street, Snow Hill, LONDON, E.C.

PATENT SAFETY ATLAS CHANDELIERS, Sun and Star Burners, Outside Lamps, Patent Reflecting Lamps, Portable Coppers for either Gas or Fuel. Iron Tube and Fittings. Best quality for Gas, Steam, or Hot Water, &c. &c.

HARRIS and PEARSON,
PROPRIETORS OF
BEST CLASS-HOUSE POT AND CRUCIBLE CLAY.
MANUFACTURERS OF
FIRE BRICKS, GAS RETORTS, &C.
AMBLECOTE FIRE CLAY AND BRICK WORKS,
STOURBRIDGE.
Late in the occupation of L and W. King.
Originally J. Pidcock, Esq.

NB. A quantity of best Clay Retorts in stock, viz.—Circulars, 14 inches, 15 inches. 16 inches.
D's, 16×12, 15×14, 20×16, 16×18.

NO CHIMNEY WANTED

FOR RICKETS & HAMMOND'S PATENT CALORIFERE GAS-STOVES, in Churches, Halls, or Shops; and for Conservatories, or any close apartment, a Pipe can be attached to carry away the burnt air.

AGAR STREET, STRAND, LONDON.—LIBERAL DISCOUNT TO THE TRADE.

TO GAS COMPANIES.

STOKERS' GLOVES,
11s. per Dozen.
S. CARPENTER, 3, BOW COMMON.

TO GAS COMPANIES AND CONTRACTORS.

FOR Sale, several lengths of Hydraulic MAIN, 14 inches diameter and 6 feet 9 inches long, with 7 holes for DIP-PIPES.

Also 4-inch ASCENSION-PIPES, and 3-inch ARCH and DIP-PIPES, and RETORT MOUTHPIECES, all in excellent condition, and will be sold at a very low price, and delivered, if required, at any Railway Station in London.

To be seen, on application to the ENGINEER, at the Equitable Gas Company's Works, Lupus Street, PIMLICO.

LEONI'S Patent Adamas Gas- BURNERS (secured by Her Majesty's Royal Letters Patent), are entirely free from liability to CORROSION, injury from Heat, or danger of Fracture, and are UNALTERABLE in the dimensions of their Apertures.

Uniformity in the consumption of Gas is obtained by the process of manufacture, which ensures that the Burners shall be of precisely similar pattern.

The Adamas Burners are confidently recommended to Gas-Fitters, Consumers, and Companies.

Sole Manufacturer and Patentee in Great Britain, S. LEONI, Adamas Works, St. Paul Street, New North Road, LONDON, N.

METROPOLITAN BOARD OF WORKS.

MAIN DRAINAGE OF METROPOLIS.

MIDDLE-LEVEL SEWER.

TO Builders and Contractors expe- rienced in TUNNEL WORKS.—The Metropolitan Board of Works hereby give notice, that they will MEET in the Council Chamber, Guildhall, in the City of London, on Friday, the 21st day of December, at Twelve o'clock at noon precisely, and will then be prepared to open TENDERS by parties who may be willing to CONTRACT for the CONSTRUCTION of MAIN BRICK SEWERS, 12 miles 1280 feet in length, or thereabouts (33,862 feet of this length being in Tunnel), and for the execution of other works in connexion therewith (including certain works already executed, either wholly or in part referred to in the Specification), to extend from a point between the Northern High-Level Sewer, east of Sir George Duckett's Canal, and the western arm of the Counter's Creek Main Sewer, near Kensal Green, in the county of Middlesex.

The Contractor is to make himself acquainted with the nature, extent, and condition of the Works already executed, either wholly or in part referred to in the Special Clauses of the Specification above mentioned, and to satisfy himself upon all points and matters connected therewith, or in relation thereto, to enable him to make the requisite allowances or charges, as circumstances may require, in framing his Estimate for the whole of the Works comprised in the said Specification.

Parties desirous of submitting Tenders may, upon payment of £3, obtain Plans, Sections, Specification, Form of Tender, and other particulars, on application to Mr. J. W. BAZALGETTE, Engineer of the Board, at the Office of the Board, between the hours of Nine a.m., and Four p.m.

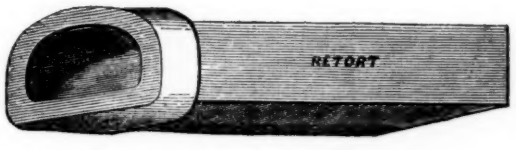
Tenders addressed to the Metropolitan Board of Works, must be delivered at the Office of the Board, No. 1, Greek Street, SOHO, before Four o'clock p.m. on Thursday, the 20th day of December, 1860, and no Tender will be received after that hour.

The Board do not bind themselves to accept the lowest or any Tender, and the party whose Tender shall be accepted will be required to provide two approved sureties for the due performance of the works.

JOHN POLLARD, Clerk of the Board.

No. 1, Greek Street, Soho, Nov. 29, 1860.

KING BROTHERS, Stourbridge Fire-Brick and Retort Works.



KING BROTHERS beg especially to call the attention of Gas Companies to the superiority of their Retorts, which are made from the celebrated STOURBRIDGE FIRE-CLAY. Mr. King has patented a Kiln for burning Retorts, by which Patent all Cold Air is excluded from the Kiln while burning, thus rendering them FREE FROM CRACKS AND CORRECT IN FORM. By great care in Manufacturing, combined with the advantages in burning, a VERY SMOOTH SURFACE is obtained, rendering them less liable to carbonize.

Retort Ovens, Fire-Bricks, Guards, Saddles, Rabbitted Burs, Flues, and Quarries, are all Manufactured of the same quality of Clay.
Every Retort and Brick is branded "King Brothers, Stourbridge."

WILLIAM SUGG,
MANUFACTURER OF
PATENT DRY AND WATER GAS-METERS, TEST GASHOLDERS, AND APPARATUS,
"EVANS'S" PHOTOMETERS,
Experimental Meters, Minute Clocks, &c., Station Meters and Governors,
STREET-LAMP GOVERNORS AND LAVA BURNERS,
19 and 20, MARSHAM STREET, WESTMINSTER.

WILLIAM INGHAM AND SONS,
WORTLEY FIRE-BRICK AND RETORT WORKS,

Near

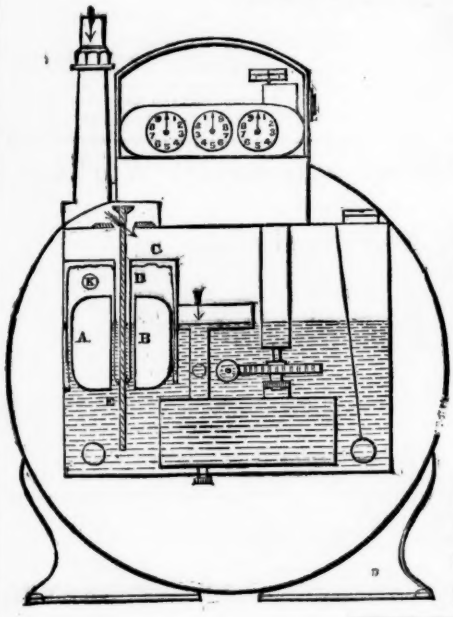
Leeds.

W. INGHAM and SONS, having for many years been extensively engaged in the Manufacture of
RETORTS AND FIRE-BRICKS FROM THE CELEBRATED WORTLEY FIRE-CLAY,
beg to call especial attention to their RETORTS, which have for many seasons proved to be unsurpassed in quality by any in the Kingdom, their FREEDOM FROM CRACKS and the ADHESION OF CARBON rendering them worthy the attention of all parties interested in the making of Gas.
The Works are of such magnitude as to ensure the prompt execution of orders to any extent.
Estimates for Setting, or Bricklayers sent when required.
GAS OVENS IN SEGMENTS OF EQUAL QUALITY.
A large stock of Fire-Bricks, Fire-Clay, Terra Cotta, and Drain-Pipes of all sizes kept in London at CHRISTIE & CO.—Wharf, 64, Bankside, Southwark, where all particulars of Prices, &c., may be obtained.
N.B.—*Export orders continue to have prompt attention.*

LIVESEY FIRE-CLAY WORKS,
NEAR BLACKBURN, LANCASHIRE.
ORLANDO BROTHERS,
MANUFACTURER OF PATENT CLAY RETORTS,
AND EVERY DESCRIPTION OF
TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.
FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

WILLIAM PARKINSON AND CO.,
(SUCCESSORS TO THE LATE SAMUEL CROSLEY,)
COTTAGE LANE, CITY ROAD, LONDON, E.C.
Established 1816.

PATENTEES AND MANUFACTURERS OF
STATION-METERS & GOVERNORS,
CONSUMERS' METERS & GOVERNORS,
AND OTHER GAS APPARATUS. Also,
METERS FOR MEASURING WATER.



IMPROVED LOW-SPOUTED GAS-METER,
WITH
NEW PATENT FLOAT ARRANGEMENT.

The Float A is partitioned off from the front frame considerably below the water-line, and is pierced perpendicularly by a tube B.

A large gas-way, C, is left between the top of the partition and the valve-seat. The small tube D, in which the float-wire works, is fixed to the top of the partition, and comes down below the water-line inside the tube B. The float-wire is soldered to the float at E, so as to allow water to pass into the tube D, in order to seal it. The chamber above the float is open to the outlet through the hole K.

The action of this float is exactly opposite to that of ordinary meters. The float is elevated by sudden pressure, and the valve cannot be closed except through want of water.

W. P. and Co. beg especially to call the attention of Gas Companies and others to this New Patent Meter, which entirely overcomes the difficulty experienced by ordinary wet meters, owing to the short range of the float, which is necessary in order to meet the requirements of the "Sale of Gas Act."

They are prepared to supply
TEST GASHOLDERS,
of the most approved description, graduated by the Standard.

CROSLEY & GOLDSMITH'S

PATENT SELF-ADJUSTING & COMPENSATING GAS-METERS

CANNOT BE OVER OR UNDERCHARGED WITH WATER,

and they consequently register the quantity of Gas consumed with greater accuracy than Meters in which the Water-Line is variable.

MANUFACTURED BY

CROSLEY & CO.,

GAS-METER MANUFACTURERS,

103, SOUTHWARK BRIDGE ROAD, LONDON, S.E.

N.B. The Patent Self-Adjusting and Compensating Apparatus may be applied to the ordinary Meter.

Manufacturers of LOWE'S PATENT MOTIVE-POWER METER, for situations where there is an inadequacy of pressure to supply the special requirements of certain consumers in low grounds during the day or night.

Also, Manufacturers of EXPERIMENT METERS, GOVERNORS, MINUTE-CLOCKS, PHOTOMETERS, &c., &c., similar to those used by Mr. King, of Liverpool.

CROSLEY & CO. are also prepared to supply Gas Companies and others with

DUPLICATES of Mr. KING'S CUBIC FOOT TRANSFERRER,

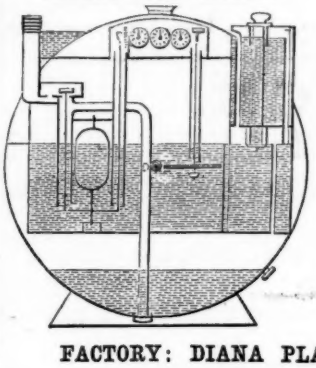
similar to that manufactured by them, and verified by the ASTRONOMER ROYAL, and PROFESSOR MILLER, of Cambridge, on behalf of the Government, which was deposited by C. & Co. in the Office of the COMPTROLLER-GENERAL of the EXCHEQUER before Nov. 13, 1859, in compliance with the "Act for Regulating Measures used in Sales of Gas." They also supply

TEST GASHOLDERS,

Graduated by the Standard Cubic Foot.

C. and Co. are the only house in the trade which has for years manufactured Meters according to the standard measure set forth in the 2nd Section of the "Sale of Gas Act," and which also comply with the rules laid down in the Section for testing meters. Purchasers of C. and Co.'s Meters may therefore be secured against any additional expenses being incurred in order to adapt their Meters to the requirements of the new Act.

PATENT WET METER.



N. DEFRIES,

CONSULTING GAS ENGINEER,

Inventor and Patentee

OF

WET GAS-METERS,

WITH SELF-ADJUSTING WATER-LINE;

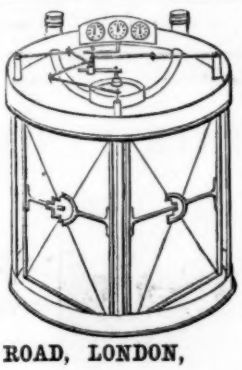
DRY METERS,

GAS-HEATING BATHS, OVENS, STOVES,

GAS FIRES with INDESTRUCTIBLE FUEL,

&c., &c.

PATENT DRY METER.



FACTORY: DIANA PLACE, FITZROY SQUARE. OFFICE: 406, EUSTON ROAD, LONDON,

Eight Doors from Factory.

Attempts having been made to construct Self-Supplying Apparatus to Wet Gas-Meters upon the Bird Fountain principle,—which, although unerring to supply water in the open atmosphere, has not wholly succeeded so as to be relied upon when enclosed in a Gas-tight Meter Case,—N. DEFRIES begs leave most respectfully to acquaint Gas Companies, and the Public in general, that he has constructed his PATENT WET GAS-METER upon a method entirely different, being founded on the well-known principle of the self-acting supply of the Oil Lamp, which has never been applied for the adjustment of the Meter Water-Line before, and which, by the admission of external air to a chamber sealed from Gas, will never fail to faithfully perform its required function. They are of the very best materials and workmanship, will stand more pressure than is required as the test for soundness by the New Act, are guaranteed to prevent surreptitious burning without detection, and will be kept in repair free of charge for seven years.

N. DEFRIES'S CELEBRATED DRY METERS,

of which more than 80,000 are in use in Palaces, Churches, Chapels, Royal Dockyards, Club Houses, Public Offices, and other Buildings throughout the Empire and Continent, which have done so much in checking surreptitious burning, and simplified the fitting up of Gas.

To remove any doubt of accuracy of measurement his Meter for 1500 lights, in use upwards of ten years at the Royal Italian Opera, until that Building was destroyed by Fire, was long afterwards dug out of the burnt ruins, then tested by the Chartered Gas Company in the presence of George Lowe, Esq., F.R.S., and other Chief Officers, and found inflexibly correct. Also, on the 9th of June, 1858, at the Western Gas-Works, his Meter for 150 lights, after considerable use, was doubted, and subjected to the most variable tests—from the full lighting to a single Jet—and in each case, as in other instances, accuracy was finely indicated.

As to durability, his two large Meters at the Thames Tunnel have been in use night and day for upwards of twelve years—one continuation of dark hours—subjected to the wear and tear of seventy-five years as compared with the ordinary business hours of using Gas above ground.

LORD REDESDALE'S SALE OF GAS BILL.

All Meters constructed by N. DEFRIES are guaranteed to pass the Provisions of the Standard.

No alteration has been necessary in the Meters he continues to supply to the Chartered, Imperial, City of London, Equitable, and other large Companies, his accustomed range of 1 per cent. over and under meeting all the desired requirements; whereas, by the New Act, a greater departure from accuracy—viz., 2 per cent. fast to 3 per cent. slow—is permitted.

SALE OF GAS ACT.

MESSRS. CROLL, RAIT, AND CO.,

Manufacturers of Croll's Patent Improved

DRY GAS-METER,

Also Manufacture and Supply

TEST GAS-HOLDERS,

And other Apparatus required by the Inspectors appointed in pursuance of the above Act.

Application for particulars to be made to the Factory,

CANAL BRIDGE, KINGSLAND ROAD, LONDON, N.E.

ALEXANDER WRIGHT,

55 and 55A, MILLBANK STREET, WESTMINSTER, S.W.,

MANUFACTURER OF

CONSUMERS' COMPENSATING & NON-COMPENSATING WET GAS-METERS,

Of the best material and workmanship, carefully adjusted to meet the requirements of the SALES OF GAS ACT.

STATION-METERS & GOVERNORS,

WRIGHT'S REGISTERING PRESSURE-GAUGE, EXHAUSTER REGISTER, & REGULATOR;

STANDARD TEST GASHOLDERS;

Consumers' Governors; Inspectors' Pocket, King's, and all other kinds of Pressure-Gauges; Thermometers for Condensers, Pressure Registers, &c., &c.

EXPERIMENTAL TESTING APPARATUS,

Employed by the best experimenters in this country and on the continent, and by the Gas Testers in the London districts.

PHOTOMETERS, SPECIFIC GRAVITY APPARATUS, BI-SULPHURET OF CARBON TEST, THOMPSON'S BROMINE AND HEATING POWER OF FUEL TESTS, IMPROVED ALKALIMETER, EXPERIMENTAL METERS AND GOVERNORS, MINUTE CLOCKS, &c., &c.

"Analysis of Gas for Practical Men," by A. WRIGHT, M. Inst. C.E., post-free for 13 Stamps. PRICE-LISTS ON APPLICATION.

JAMES MEACOCK,

PATENT DRY AND WET GAS-METER MANUFACTURER,

7, SNOW HILL, AND 16, WEST STREET, LONDON.

ESTABLISHED 1836.

J. M. invites attention to his Improvements in **EXPERIMENTAL WET GAS-METERS**, by which he renders impossible any Leakage from the Stuffing-Box.

These METERS are **GUARANTEED** to meet all the Requirements of the **SALE OF GAS ACT**

GOVERNORS, STATION-METERS, PHOTOMETERS,

EXPERIMENTAL TESTING GASHOLDERS, HIGH-PRESSURE GAUGES,

AND ALL APPARATUS IN USE AT THE GAS MANUFACTORY.

D. HULETT and CO., 55 and 56, HIGH HOLBORN, LONDON,

PATENTEES and MANUFACTURERS of the ONLY GOOD MERCURIAL GAS REGULATOR,

invite the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

MANUFACTURERS OF

GAS CHANDELIERS, GLASS LUSTRES, HALL LANTERNS, VESTIBULES, BRACKETS, PENDANTS;

DOUBLE CONE, ALBERT, SHADOWLESS, & EVERY DESCRIPTION OF BURNER, UNION JETS, BATSWINGS, ETC.;

IMPROVED FULL-WAY CARTER'S VALVES (much approved of);

GAS-STOVES, and every article connected with Gas Apparatus.

CAST & WROUGHT-IRON PIPE, BLACK & GALVANIZED. COPPER. TIN, BRASS, & COMPOSITION TUBING.

D. HULETT'S IMPROVED SERVICE CLEANSER

for clearing out Mains, Services, and Interior Fittings—60s. net.

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Large Pattern Books, with every description of Gas-Fittings, Chandeliers, &c., with complete Book of Prices, 12s.

London: Printed by WILLIAM BOUGHTON KING (at the office of Joseph Clayton, 17, Bouverie Street, Fleet Street); and published by him at No. 11, Bolt Court Fleet Street, in the City of London.—Tuesday, December 18, 1860.